



Proceedings of the tenth meeting of the Advisory Board of the Imperial Council of Agricultural Research

**Held at Simla on the 3rd, 4th, 5th, 6th, 7th and 8th
September 1934**

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Schedule of papers circulated to Members of the Advisory Board of the Imperial Council of Agricultural Research for its tenth meeting held at Simla, on the 3rd, 4th, 5th, 6th, 7th and 8th September 1934

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AGENDA FOR THE MEETING OF THE ADVISORY BOARD OF
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH
TO BE HELD ON THE 3RD TO 8TH SEPTEMBER 1934.

1. Decisions of the Governing Body on the recommendations of the Advisory Board made at the latter's meeting in February 1934.

2. Appointment of Committees.

3. Proceedings of the first meeting of the Cattle Breeding Committee appointed by the Imperial Council of Agricultural Research.

4. The Report on Coconut Enquiry in India by Dr. Patel.

5. The fourth Annual Report of the Imperial Agricultural Bureaux.

6. A. Progress Report on the working of the Botanical Sub-Station at Karnal for the year ending June 1934.

B. Scheme for the extension of the Botanical Sub-Station at Karnal for a period of five years from September 1935, at a cost of Rs. 1,54,512.

7. Application from the Director, Imperial Institute of Agricultural Research, Pusa, for a grant of Rs. 29,360 spread over five years for a scheme for research on the cytology of Indian crops at Pusa.

8. Proceedings of the Second Meeting of the Fertilisers Committee.

9. Existing condition of the fishing industry and its possibilities of development in so far as supplies of fish manure are concerned.

10. Application from the Government of Madras for a grant of Rs. 92,487 spread over a period of three years for a scheme of research for improving the fishing industry and developing the supply of fish manure.

11. Question of the need for an All-India Fertilisers Act.

12. Experiments on some methods of disintegrating bones by previous fermentation.

13. Application from the Imperial Institute of Veterinary Research, Muktesar, for the appointment of a Research Officer for five years to investigate into contagious abortion of cattle, sheep and goats at an estimated cost of Rs. 1,00,763, if an Indian is appointed and at Rs. 1,44,141 in case of an officer of non-Asiatic domicile.

14. Recommendations of the Crop Planning Sub-Committee of the Advisory Board of the Imperial Council of Agricultural Research, June 1934.

15. Proposal for the appointment of Standing Committees on Rice and Wheat under the Imperial Council of Agricultural Research.

16. Report of Mr. K. P. R. Kartha on milk production statistics.

17. Application from the Government of Bombay for a grant of Rs. 29,070 spread over three years for a Scheme of research in Apiculture by Mr. C. J. George, Professor of Botany, Wilson College, Bombay.

18. Application from the Government of Baroda for a grant of Rs. 16,900 spread over five years for a Scheme of research on Bee-keeping for Gujerat.

19. Proposal to institute a regular system of scholarships by the Imperial Council of Agricultural Research for the training of Agricultural Research workers in India.

20. Proceedings of the Second Meeting of the Animal Nutrition Committee appointed by the Imperial Council of Agricultural Research.

21. Proceedings of the first meeting of the Dairy Committee appointed by the Imperial Council of Agricultural Research.

22. Application from Mr. J. J. DeValois, Principal, American Arcot Mission, Agriculture Institute, Katpadi, Madras, for a grant of Rs. 78,876 for goat breeding in the Madras Presidency spread over a period of 10 years.

23. Annual Reports on the working of the Rice Research Schemes in Madras and the United Provinces (1933-34) and the Central Provinces (September 1932 to March 1934).

24. Application from the Government of Bengal for a grant of Rs. 43,152 spread over three years for a Scheme of research work on the Physiology of the rice plant by Dr. S. P. Agharkar of the Calcutta University.

25. Application from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 15,864 spread over three years for a scheme to investigate the preparation of eggs for marketing and other methods of disposal.

26. Application from the Government of Madras for a grant of Rs. 37,580 spread over a period of ten years for sheep breeding research in Madras.

27. Application from the Government of Hyderabad for a grant of Rs. 77,960 spread over a period of 10 years for a scheme of research in Sheep breeding.

28. Scheme from the Government of Madras for an investigation into the quality of rice.

29. Progress report for the year 1933-34 on the scheme of research work on rice physiology by Dr. R. H. Dastur, Royal Institute of Science, Bombay.

30. Application from the Government of Bengal for a grant of Rs. 21,600 spread over five years for a scheme of research on the biochemical and physico-chemical properties of rice at the Bio-Chemical laboratory of the Dacca University.

31. Scheme from the Government of Bihar and Orissa for research on the quality of rice.

32. Application from the Government of the Central Provinces for a grant of Rs. 10,088 spread over four years for research work on the "gangi" pest of rice-Entomological work under the scheme of rice research already sanctioned by the Council for the Central Provinces.

33. Application from the Government of Bengal for a Supplementary grant of Rs. 15,571 in connection with the appointment of a Physiological Chemist to study Animal Nutrition problems at Dacca.

34. Recommendations of the Tobacco Sub-Committee of the Advisory Board of the Imperial Council of Agricultural Research.

35. Application from the Andhra University for a grant of Rs. 1,000 for a Scheme to find out the best method of extracting Nicotine commercially from tobacco waste and to design an apparatus for the same.

36. Progress Reports on Veterinary Research Scheme sanctioned by the Imperial Council of Agricultural Research :—

- (i) Annual Report on the work of the Veterinary Investigation Officer, Madras, for 1933-34.
- (ii) Annual Report on the work of the Veterinary Investigation Officer, Bihar and Orissa, for 1932-33 and 1933-34.
- (iii) Annual Report on the work of the Veterinary Investigation Officer, Hyderabad, for 1932-33 and 1933-34.
- (iv) Annual Report on the work of the Veterinary Investigation Officer, Punjab, for 1932-33 and 1933-34.
- (v) Annual Report on the work of the Veterinary Investigation Officer, Bombay Presidency, for 1933-34.
- (vi) Annual Report on the work of the Veterinary Investigation Officer, Central Provinces, for 1932-33 and 1933-34.
- (vii) Annual Report of Dr. A. E. Slater's goat breeding scheme for the year 1933-34.

37. Application from the Andhra University for a grant of Rs. 18,200 spread over a period of five years for a study of fruits and vegetables with a view to their utilisation in manufacture.

38. Application from the Government of North-West Frontier Province for a grant of Rs. 27,350 spread over a period of five years for research on the improvement of fruit culture in the North-West Frontier Province and the problem of marketing.

39. Application from H. E. H. the Nizam's Government, Hyderabad, for a grant of Rs. 58,610 spread over a period of 5 years for a fruit research Scheme.

40. Application from the Government of Mysore for a grant of Rs. 88,880 spread over a period of five years for a Scheme for fruit cultivation in the Mysore State.

41. Proposal to appoint three Assistants on Rs. 120—10—150 each in the place of the Physiological Botanist under the scheme of fruit research in Bihar and Orissa.

42. Report on the experimental consignments of mangoes from Bombay to Great Britain during 1933.

43. Note by Sir Harry Lindsay, Indian Trade Commissioner, London, on the subject of experimental consignments of fruit from India to the United Kingdom.

44. Application from the Government of Madras for a grant of Rs. 74,000 spread over five years for a scheme of research work on bananas.

45. Programme of work on the Bombay Cold Storage Research Scheme for 1934, 1935 and 1936.

46. Application from the Government of Bengal for an extension of the scheme of research on the mechanical analysis of lateritic soils and on the nutrition of the rice plant at the Dacca University.

47. Progress Report for 1933-34 on the Scheme of research into the properties of colloid soil constituents by Professor J. N. Mukherjee of the Calcutta University.

48. Scheme from the Government of Bihar and Orissa for research on the regeneration of sand affected lands in Bihar and Orissa.

49. Note by Mr. Churchill, Dy. Director of Agriculture, Northern Circle, Central Provinces, on sann hemp as a fibre crop in the Central Provinces.

50. Application from the Government of Madras for a grant of Rs. 1,500 spread over three years for a scheme of experiments on the improvement of sann hemp fibre at the Agricultural Research Station, Samalkota.

51. Application from the Government of Bombay for a grant of Rs. 1,500 spread over three years for research work on sann hemp in the Bombay Presidency.

52. Application from the Government of the Central Provinces for a grant of Rs. 20,060 spread over five years for a scheme of research work on sann hemp in the Central Provinces.

53. Application from the Andhra University for a grant of Rs. 5,000 spread over a period of two years for a scheme to investigate the commercial production of Sweet Potato Starch by Dr. D. G. Walawalkar, B.Ag., M.Sc., Head of the Department of Technology, Andhra University.

54. Annual Report of the Madras Potato research Scheme for the year 1933-34.

55. Potato Breeding Scheme for Northern India.

56. Report on the investigations on cereal rusts by Dr. K. C. Mehta for the year 1933-34.

57. Application from the Government of the United Provinces for a grant of Rs. 1,24,000 for the continuance of the investigations on cereal rusts by Dr. K. C. Mehta, Professor of Botany, Agra College, for a further period of three years from March 1935.

58. Application from the Government of the Central Provinces for a grant of Rs. 46,200 spread over a period of four years for a scheme of research work on pan cultivation.

59. Report of the Tractor Ploughing work carried out by the Burma Shell Oil Storage and Distributing Company of India, Ltd., Bombay, during the 1933-34 season.

60. Progress made in the preparation of Statistical notes on the technique of field experiments by the Statistician to the Imperial Council of Agricultural Research.

61. Printing of Progress Reports on Research Schemes.

62. Application from the Government of Bengal for a grant of Rs. 5,000 spread over two years for a scheme for investigating the Biology, Anatomy, and development of pulse beetles (*Bruchidae*), with special reference to remedial measures against these pests by Mr. D. D. Mukherji, Lecturer in Zoology, University College of Science and Technology, Calcutta.

63. Adoption of measures to prevent the further spread of San Jose Scale, a serious fruit pest in India.

64. Provincial Schemes for the improvement of Agricultural Marketing.

65. Proposal to appoint provincial dairy Committees.

66. Progress Reports on Veterinary Research Schemes sanctioned by the Imperial Council of Agricultural Research :—

- (i) Annual Report on the work of the Veterinary Investigation Officer, Bengal, for 1932-33 and 1933-34.
- (ii) Annual Report on the work of the Veterinary Investigation Officer, Assam, for 1933-34.
- (iii) Annual Report on the work of the Veterinary Investigation Officer, United Provinces, for 1933-34.

N. B.—Please treat item No. 19 of the Agenda as cancelled.

Proceedings of the Tenth Meeting of the Advisory Board of the Imperial Council of Agricultural Research held at Simla on Monday, the 3rd September 1934.

The following were present :—

- 1. Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E., *Chairman*.
- 2. Mr. B. K. Badami.
- 3. Dr. W. Burns.
- 4. Mr. B. C. Burt.
- 5. Mr. M. Carbery.
- 6. Mr. J. N. Chakravarty.
- 7. Mr. R. T. Davis.
- 8. Mr. G. K. Devadhar.
- 9. Mr. T. J. Egan.
- 10. Mr. E. S. Farbrother.
- 11. Khan Bahadur Maulvi Fateh-ud-Din.
- 12. Dr. J. C. Ghosh.
- 13. Dr. L. K. Hyder.
- 14. Dr. V. N. Likhite.
- 15. Mr. A. M. Livingstone.
- 16. Mr. A. McKerral.
- 17. Brigadier H. S. Mosley.

18. Mr. A. M. Mustafa.
19. Mr. Nizamuddin Hyder.
20. Lt.-Col. E. Noel.
21. Colonel A. Olver.
22. Mr. T. F. Quirke.
23. Mr. S. V. Ramamurty.
24. Mr. P. B. Richards.
25. Mr. J. H. Ritchie.
26. Mr. C. V. Sane.
27. Mr. P. T. Saunders.
28. Mr. D. R. Sethi.
29. Dr. F. J. F. Shaw.
30. Rao Bahadur C. T. Tadulingam.
31. Mr. G. T. Tait.
32. Mr. W. Taylor.
33. Mr. C. G. Trevor.

The following attended as visitors :—

1. Dr. S. P. Agharkar.
2. Mr. D. Bal.
3. Dr. J. K. Basu.
4. Mr. E. J. Bruen.
5. Mr. A. P. Cliff.
6. Professor R. H. Dastur.
7. Mr. R. Y. Hill.
8. Mr. S. N. A. Jafri.
9. Mr. H. C. Javaraya.
10. Dr. P. G. Krishna.
11. Dr. P. E. Lander.
12. Dr. K. C. Mehta.
13. Mr. K. A. Menon.
14. The Hon'ble Mr. E. Miller.
15. Professor J. H. Mitter.
16. Mr. I. D. Mohendra.
17. Mr. A. Mohiuddin.
18. Mr. John A. Munawar.
19. Dr. B. C. Pal.
20. Professor P. K. Parija.
21. Mr. K. P. Pillai.
22. Mr. K. G. Raju.
23. Mr. T. S. Sabnis.
24. Dr. K. C. Sen.
25. Mr. S. I. A. Shah.
26. Mr. M. Vaidyanathan.
27. Rao Bahadur B. Viswanath.

In the absence of Rai Sahib Malik Charan Das, Mr. Bazlul Karim acted as Secretary.

2. The meeting lasted from 12 noon to 1-45 p.m., to enable the Committee on Rice Research Schemes and the Standing Cattle Breeding Committee to meet in the afternoon.

3. The Chairman at the outset welcomed the members of the Board and said that since the Board last met Mr. A. M. Livingstone, the Marketing Expert, had joined the Council. He also informed the Board that the Standing Finance Committee had approved the grants for the marketing scheme and for the establishment of a Central Dairy Institute for which Colonel Olver had been trying for the past four years.

4. *Appointment of Committees. (Subject No. 2 of the agenda, Appendix I).*—The proposals circulated were accepted with the additions shown below :—

Rice Committee.—

Mr. A. M. Livingstone.

Dr. V. N. Likhite.

Fruit Committee.—

Mr. A. M. Livingstone.

It was also agreed that all Provincial Senior Marketing Officers present would be welcome at the meetings of any sub-committees in which they might be interested.

Sann Hemp Committee.—

Mr. A. M. Livingstone.

Rust Research Committee.—

Mr. C. V. Sane and Dr. V. N. Likhite.

Potato Committee.—

Mr. A. M. Livingstone.

Standing Cattle Breeding Committee (added for the present meeting).—

Dr. Badami,

Mr. C. V. Sane,

Mr. Nur-ul-Islam,

Mr. A. M. Livingstone,

Mr. Egan,

Mr. Trevor,

and Directors of Agriculture and Veterinary Services who were members of the Committee which considered the Bombay Goat and Sheep Breeding Schemes and the Hyderabad Sheep Breeding Scheme in August 1933 who were present at the meeting of the Board.

Standing Animal Nutrition Committee (added for the present meeting).—

Mr. Carbery.

Mr. Bal.

Mr. Taylor.

Progress Report Committee (Animal Husbandry).—

Mr. E. J. Bruen.

Mr. G. K. Devadhar.

5. *Existing condition of the fishing industry and its possibilities of development in so far as supplies of fish manure are concerned. (Subject No. 9 on the agenda, Appendix II).*—Rao Bahadur B. Viswanath said that the subject was discussed at the last meeting of the Fertilisers' Committee and that in view of the importance of the fishing industry for fish manure and as food for livestock the committee recommended to the Board that the various provinces should be asked to develop the industry. He added that fish manure was a very important manure for Indian soils and it was therefore very necessary that this an indigenous manure which combined in a concentrated form both the nitrogenous as well as phosphatic manure should be encouraged. Colonel Olver said that fish meal if plentiful would form a valuable feed for livestock in this country. The difficulty at present experienced was the absence of a regular supply. He therefore emphasised the importance of continuing the work which was being done in Madras with a trawler in surveying the fishing grounds round the coast, and thought that the fishing industry right round the coast of India was one which deserved encouragement. He suggested that an expert committee should be appointed to deal with the whole question on a broad scale. Mr. Ramamurty was in agreement with what Colonel Olver had said and added that if the I. C. A. R. forwarded the recommendations of the committee to the various Local Governments who were interested they would perhaps devote greater attention to the subject than now. Messrs. Carbery and Sethi were also of the opinion that it would be useful to forward the recommendation of the Fertilisers Committee to Local Governments. The Advisory Board endorsed the recommendation of the Fertilisers Committee.

6. *Application from the Government of Madras for a grant of Rs. 92,487 spread over a period of three years for a scheme of research for improving the fishing industry and developing the supply of fish manure. (Subject No. 10 on the agenda, Appendix III).*—Mr. Ramamurty in introducing the scheme said that in the West Coast of Madras there was a large surplus of fish which could not be consumed locally. He said that the supply of fish had varied from year to year for the last ten years and on an average he estimated that the value of the supply would be about Rs. 8 lakhs per annum. Some years ago the Madras Government had some research done in regard to the preparation of fish manure and fish meal. The East Coast of the Madras Presidency had also been surveyed by the trawler and it was found that there was five times as great a supply there as in the West Coast, and that if these fisheries were developed there would be plenty of material available for conversion into fish manure and fish meal. He therefore supported the recommendation of the Fertilisers' Committee regarding the bio-chemical work which was proposed by the Madras Government in order to make economic use of the material already available. The Madras Government he thought would not be content with making use of the material available but would also exploit the new sources. In reply to a question put by Mr. Livingstone, Mr. Ramamurty said that they had a second-hand trawler bought in England some ten years ago but as it gave trouble it was recently sold. There were now a number of new fishing grounds which had been surveyed

but not exploited. Dr. Burns, in opposing the scheme, said that the manufacture of fish manure and fish meal was only a subsidiary item of the main question and until it was known from the Madras Government whether they would again take up deep sea fishing the scheme should not be passed. Mr. Livingstone agreed with Dr. Burns. He said that the development of the fishing industry was more important than the development of existing factories to produce fish manure, and that the problems of proper marketing of fish meal and storage in refrigerating vans were more important than the question of production of fish manure. He was of the opinion that without holding up the Madras Scheme in any way a Committee should be appointed to expand the Madras Scheme so as to cover any enquiry into the production, manufacture and utilisation of fish and fish products generally. It was also elicited in the course of discussion that except in Madras, Cochin and Travancore, the Fisheries Departments in maritime provinces had been closed. That being so, Mr. Livingstone was of the opinion that a central Committee should be appointed by the Imperial Council of Agricultural Research to deal with work connected with fisheries. Dr. Hyder opposed the scheme on the ground that Sir Frederick Nicholson, a former Director of the Department of Fisheries, Madras, had expressed the view that the expenditure was unnecessary and unwarranted and that the oil produced in Madras was first class. Rao Bahadur Viswanath supported the Scheme and said that subjects Nos. 9 and 10 were inter-connected and that the fishing industry should be developed firstly for the purpose of producing fish for edible purposes, secondly to produce fish manure free from defects such as oil, sand, etc., and capable of readily undergoing decomposition in the soil and thirdly to produce oils to supplement cod liver oil and for the purpose of soaps, etc. He said that the Madras Government scheme should be accepted and sanctioned without undue delay. Mr. Ramamurty in replying to the criticisms said that he welcomed the suggestion of appointing a central fisheries committee but that the Madras Government scheme should not be postponed as there were plenty of grounds to exploit. He was of the opinion that after the fields already discovered had been exploited, the Madras Government would consider the question of purchasing a new trawler. After several members had spoken it was suggested by Mr. Burt that information should be obtained before the end of the present meeting of the Board as to what the Madras Government have done to exploit the new sources located by the trawler. Mr. Ramamurty promised to obtain information by telegram from the Madras Government. Further consideration of the Scheme was therefore postponed till Friday, the 7th September.

*Question of the need for an all-India Fertilizers Act. (Subject No. 11 of the agenda, Appendix IV).—*Mr. Burt explained that this subject was considered by the Fertilisers Committee at its first meeting and members of the Committee were asked to investigate the question in their own provinces pending the second meeting. At the second meeting there was a great diversity of opinion not so much as to the desirability of the Act but as to the possibility of enforcing it if one were passed. It was also pointed out by several members of the Committee that at the moment there was a need for more of retailers of fertilisers and that legislation might discourage these. The Committee therefore suggested simplified legislation which would only enforce proper labelling and desired that opinions should be obtained. A number of firms selling fertilisers did

not even agree to this. One or two provinces had pointed out that they had felt the need for a Fertilizers Act and therefore the Fertilizers Committee suggested that the question of a preliminary step insisting on a correct labelling of all fertilizers which are kept in bags and in the form of cakes should be examined. The members were asked to send in their opinions as to how far the Act, if passed, would work in their provinces and also to ascertain the opinions of some of the larger fertilisers distributors. These opinions were before the Board. Mr. Burt's own feeling in the matter was that the time had come to make a start in the matter and if there was to be a legislation it was eminently desirable that it should be all-India legislation. He suggested that an attempt should be made to secure uniformity combined with the necessary elasticity by an enabling Indian Fertilisers Act which would be brought into effect in each Province (or State) as the Local Government thought fit. This will prevent the complications which would arise from several Provincial Acts, with different standards and requirements. At the same time it would give elasticity because in an Act of that kind one would always have provision for provincial rules as well as for a certain number of essential all-India rules. Whether such an Act should be brought into operation by notification or by a Resolution of the Provincial Government was a matter on which Local Governments would have to be consulted. Mr. Ritchie agreed with Mr. Burt. Mr. Devadhar said that the time had not yet come for such an Act and added that the agriculturists should first be taught the value of artificial manures and the need for demanding a certificate of composition of the manure. Mr. Ramamurty said that the Government of Madras were in favour of legislation and that in respect of manures consisting wholly or partly of chemical manures it would be possible to state the contents. Dr. Burns was of the view that the Act was long overdue. Mr. Carbery said that firms in Calcutta were not prepared to state the composition of patent manures. They wanted to keep this a secret. Mr. Burt suggested that the label might state that the manure contained not less than such and such a percentage of nitrogen, such and such a percentage of phosphates and such and such a percentage of potash—which was what the Committee had in mind when making this recommendation. There was no intention of asking the firms the actual make-up of mixtures. Mr. Burt then moved the following resolution:—

“ That in the opinion of the Advisory Board the time has now come for the introduction of an all-India Fertilisers Act of an enabling character to be brought into force in each province and State by Notification by the Local Government as found necessary.”

The resolution when put to vote was carried. Mr. Burt then moved:—

“ That a drafting Sub-Committee of the Advisory Board with power to co-opt members be appointed to prepare a draft of an all-India Fertilisers Act for submission to the next meeting of the Advisory Board.”

The resolution was carried, the personnel of the Committee was left to the Chairman of the Board.

Experiments on some methods of disintegrating bones by previous fermentation. (Subject No. 12 on the agenda, Appendix V).—Dr. Lander

introduced the scheme. Rao Bahadur Viswanath supported the proposals as they would be of direct and immediate interest to poor agriculturists. Dr. Burns referred to the work done by Rao Bahadur Sahasrabudhe and enquired whether it was the Committee's intention that the practical applicability of the work already done should be tested by a few trials. Mr. Burt observed that this was the intention. In an answer to a question of Mr. Devadhar Mr. Burt stated that the export of bones, etc., was only a small proportion of the total supply. The committee's proposals were approved.

Application from the Imperial Institute of Veterinary Research, Muktesar, for the appointment of a Research Officer for five years to investigate into contagious abortion of cattle, sheep and goats at an estimated cost of Rs. 1,00,763, if an Indian is appointed and at Rs. 1,44,141 in case an officer of non-Asiatic domicile. (Subject No. 13 of the agenda, Appendix VI).—Mr. Taylor introduced the scheme and said that a scheme on similar lines had been recommended by the Board in 1931 and that the Governing Body of the Council had rejected it. The scheme was an important one both from the point of view of economy as well as of public health. Colonel Olver supported the scheme and said that the position had changed since the original scheme was put up. With the appointment of Veterinary Investigation Officers in the Provinces valuable information could now be obtained in regard to contagious abortion, and that a specialist officer if appointed would have ample material to make a thorough study of this condition. Contagious abortion and the sterility arising from it were very important from the economic point of view and was now recognised to cause a considerable amount of sickness among human beings. Mr. Quirke strongly supported the scheme and pointed out that from the point of view of the National Horse Breeding Society it was also important to investigate equine abortion and get some knowledge of the incidence of this disease. He suggested that this investigation should also be included in the scheme. Brigadier Mosley supported Mr. Quirke. In answer to the Chairman Mr. Taylor said that there would be no increase in the expenditure by the inclusion of equine disease in the investigation. Messrs. Saunders, Farbrother and Bruen also supported the scheme. Mr. Bruen suggested that some provision, say, Rs. 20,000 should be made in order to pay compensation to private individuals from whom material would be obtained for investigation. Mr. Devadhar suggested that attempts should be made to recruit an Indian and if no Indian is available then only recruitment should be made from abroad. The Chairman explained at this stage that every attempt will be made by the Public Service Commission to recruit an Indian according to plan 1 failing which steps would be taken to recruit a man from abroad. Mr. Taylor in reply to a question of Mr. Ramamurty stated that the intention was to try the plan No. 1 and only if it failed would they have recourse to plan No. 2. The Chairman also made it clear that the charge for house-rent would not be borne by the Council. Mr. Taylor said that the scheme was drawn up on an all-India basis and that equine were not considered to be of as great economical importance as cattle but equine abortion would be dealt with as far as possible under the scheme. In the end the Chairman put the scheme to vote and it was carried. The suggestion of Mr. Bruen that Rs. 20,000 should be provided in the scheme for paying compensation to individuals was put to vote and lost.

The meeting then adjourned till 10-30 A.M., on Tuesday, the 4th September 1934.

BAZLUL KARIM,
for *Secretary*.

SIMLA,

The 3rd September 1934.

Proceedings of the Tenth Meeting of the Advisory Board of the Imperial Council of Agricultural Research held at Simla on Tuesday, the 4th September 1934.

The following were present :—

1. Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E., *Chairman*.
2. Mr. B. K. Badami.
3. Dr. W. Burns.
4. Mr. B. C. Burt.
5. Mr. M. Carbery.
6. Mr. J. N. Chakravarty.
7. Mr. R. T. Davis.
8. Mr. G. K. Devadhar.
9. Mr. T. J. Egan.
10. Mr. E. S. Farbrother.
11. Khan Bahadur Maulvi Fateh-ud-Din.
12. Dr. J. C. Ghosh.
13. Dr. L. K. Hyder.
14. Dr. V. N. Likhite.
15. Mr. A. M. Livingstone.
16. Mr. A. McKerral.
17. Brigadier H. S. Mosley.
18. Mr. A. M. Mustafa.
19. Mr. Nizamuddin Hyder.
20. Lt.-Col. E. Noel.
21. Colonel A. Oliver.
22. Mr. T. F. Quirke.
23. Mr. S. V. Ramamurty.
24. Mr. P. B. Richards.
25. Mr. J. H. Ritchie.
26. Mr. C. V. Sane.
27. Mr. P. T. Saunders.
28. Mr. D. R. Sethi.
29. Mr. S. I. A. Shah.
30. Dr. F. J. F. Shaw.
31. Rao Bahadur C. T. Tadulingam.
32. Mr. G. T. Tait.
33. Mr. W. Taylor.
34. Mr. C. G. Trevor.

The following attended as visitors :—

1. Dr. S. P. Agharkar.
2. Mr. D. Bal.
3. Dr. J. K. Basu.
4. Mr. E. J. Bruen.
5. Mr. A. P. Cliff.
6. Professor R. H. Dastur.
7. Mr. R. H. Hill.
8. Mr. S. N. A. Jafri.
9. Mr. H. C. Javaraya.
10. Dr. P. E. Lander.
11. Dr. K. C. Mehta.
12. Mr. K. A. Menon.
13. The Hon'ble Mr. E. Miller.
14. Mr. I. D. Mohendra.
15. Mr. A. Mohiuddin.
16. Mr. G. Morgan.
17. Mr. John A. Munawar.
18. Mr. Nurul Islam.
19. Dr. B. C. Pal.
20. Professor P. K. Parija.
21. Mr. K. P. Pillai.
22. Mr. K. G. Raju.
23. Mr. T. S. Sabnis.
24. Dr. K. C. Sen.
25. Mr. M. Vaidyanathan.

In the absence of Rai Sahib Malik Charan Das, Mr. Bazlul Karim acted as Secretary.

2. The meeting commenced at 10-30 A.M. and adjourned at 12-30 P.M. to enable the Marketing Committee, the Tobacco Committee and the Standing Animal Nutrition Committee to meet in the afternoon.

3. *Proposal for the appointment of Standing Committee on Rice and Wheat under the Imperial Council of Agricultural Research.* (Subject No. 15 on the agenda, Appendix VII).—Mr. Burt in introducing the subject said that on the recommendation of the Crop Planning Conference it was proposed to appoint two standing committees one for rice and another for wheat to deal with matters relating to the production, marketing and general improvement of the two crops and that these committees would be appointed by the Governing Body under Rule 30 of the Rules and Regulations of the Council. He referred to the draft constitution of the committees in Annexure III of the note circulated and suggested that these might form the basis of discussion. The Chairman of the Board said that in framing the constitution of these two Committees the Board should bear in mind two points, namely, that the Government of India attached great importance to these committees and that the committees might be constituted somewhat on the model of the Indian Central Cotton

Committee. Messrs. Ramamurty, Burns, Carbery and Richards concurred with the proposals made by the Agricultural Expert. Dr. Burns suggested the inclusion of the Crop Botanist, Bombay, and Mr. Richards and Rao Bahadur Tadulingam suggested the inclusion on the Rice Committee of all the marketing officers in the provinces who will deal with rice. Mr. McKerral, while agreeing with the proposals made, stated that a non-official representative of the Burma wholesale Rice exporters was absolutely necessary in the Committee was to carry weight in Burma. He also suggested that the meeting of the rice committee should be held in conjunction with the meetings of the Advisory Board as far as possible. Messrs. Sethi, Ritchie and Chakravarty were also in agreement with the proposals, the latter suggested the addition of the Economic Botanist, Assam, who was carrying out research on rice. After further discussion the Board agreed to the following additions being made to the rice committee,—Under (a) the Directors of Agriculture of Travancore and Cochin. Under (c) the Crop Botanist of Bombay and the Economic Botanist of Assam. Under (e) 5 and 6 should be altered to 5, 6 and 7 and should be reserved for trade representatives from Madras, Bengal and a representative of the wholesale exporters of rice from Burma.

As regards the Wheat Committee the following amendments were agreed to :—

Under (a) the Directors of Agriculture of the Central Provinces and Baroda should be added ; under (b) the N.-W. F. P. will not require any representation but a representative to be nominated by the Central Provinces Government should be added ; under (c) the Crop Botanist, Bombay, and the Economic Botanist for Rabi cereals of the United Provinces and the Eastern Bengal, Central Provinces, should be added ; under (e) one representative of the wheat trade in the Central Provinces should be added.

4. *Report of Mr. K. P. R. Kartha on milk production statistics. (Subject No. 16 on the agenda, Appendix VIII).*—The members had no comments to offer and the Board passed on to the next subject.

5. *Application from the Government of Bombay for a grant of Rs. 29,070 spread over three years for a scheme of research in Apiculture by Mr. C. J. George, Professor of Botany, Wilson College, Bombay. (Subject No. 17 on the agenda, Appendix IX).*

6. *Application from the Government of Baroda for a grant of Rs. 16,900 spread over five years for a scheme of research on Bee-keeping for Gujerat. (Subject No. 18 on the agenda, Appendix IX).*—As these two items related to the same subject they were taken together. Dr. Burns and Mr. Sane introduced the Bombay and Baroda schemes respectively. Dr. Burns said that this scheme was important in view of the fact that bee-keeping would be an useful subsidiary industry for agriculturists. Professor George was fully qualified to carry out the scheme. Mr. Ramamurty said that in Madras a considerable amount of work on bee-keeping had been done both at the Agricultural College and by the Y. M. C. A. and that they were publishing a bulletin specially devoted to bee-keeping. He also said that the Mysore Government had started work on bee-keeping and that bee-keeping was recognised as a valuable cottage industry. He

therefore suggested that before undertaking these two isolated schemes the Board might get all the information that was available in the various centres where work was being done so as to see what problems had already been solved and what remained to be done and then place all the information collected before a Sub-Committee to be appointed to determine what problems remained to be solved. These two schemes might also form material for that Sub-Committee. Mr. Richards in supporting the suggestion made by Mr. Ramamurty said that the question whether bees could be kept profitably in any locality was one which could only be answered by trial as it depended upon the flora of the area. While it was necessary that practical trials should be made locally, the question of bee-keeping in India in general appeared to be one which could best be dealt with by having one central organisation to deal with essential investigations. The importation of bees from abroad especially with reference to the exclusion of diseases should be limited to one Institution ; where such hybridisation as may be possible with indigenous Indian bees could be done under the expert assistance which would be necessary ; and from which Provinces and States draw their stocks. Mr. Burt agreed with Mr. Ramamurty and said that the matter should be referred to a committee for consideration as to what was to be done in the way of research from an all-India point of view. He also said that the Imperial Entomologist should be requested to furnish any fuller detailed information on the subject which might be available. He thought there was a lot of information available at Pusa. Mr. Ritchie agreed with Mr. Richards and suggested that men from the provinces could be trained at a Central Station. Messrs. Devadhar and Likhite however pressed for the immediate starting of these two schemes. Rao Bahadur Tadulingam fully endorsed the views expressed by Mr. Ramamurty and said that this being a subject of all-India importance his proposal should be accepted. Dr. Burns accepted the suggestion of Mr. Ramamurty. The Board decided on the appointment of a Committee and to refer the scheme to it. The selection of the personnel of the Committee was left to the Chairman of the Board. The Committee should submit its report to the next meeting of the Board.

7. *Proceedings of the Second Meeting of the Animal Nutrition Committee appointed by the Imperial Council of Agricultural Research. (Subject No. 20 on the agenda, Appendix X).*—The Board had no comments to offer.

8. *Proceedings of the first meeting of the Dairy Committee appointed by the Imperial Council of Agricultural Research. (Subject No. 21 on the agenda, Appendix XI).*—The Board had no remarks to offer. Mr. Bruen suggested that the scheme for the establishment of a Central Dairy Institute might be referred to the Director of Agriculture, Bombay, for any suggestions that he might offer.

9. *Decisions of the Governing Body on the recommendations of the Advisory Board made at the latter's meeting in February 1934. (Subject No. 1 of the agenda, Appendix XII).*—Noted.

10. *Proceedings of the first meeting of the Cattle Breeding Committee appointed by the Imperial Council of Agricultural Research. (Subject No. 3 of the agenda, Appendix XIII).*—No remarks.

11. *The fourth Annual Report of the Imperial Agricultural Bureau. (Subject No. 5 of the agenda, Appendix XIV).*—No remarks.

12. *Progress Report on the working of the Botanical Sub-Station at Karnal for the year ending June 1934. (Subject No. 6-A of the agenda, Appendix XV). Scheme for the extension of the Botanical Sub-Station at Karnal for a period of five years from September 1935 at a cost of Rs. 1,54,512. (Subject No. 6-B of the agenda, Appendix XVI).*—The Board approved the Progress Report on the working of the Botanical Sub-Station at Karnal for the year ending June 1934.

The question of the extension of the Botanical Sub-Station for a further period of five years was then considered. Dr. Shaw, in opening the discussion said that the present proposal was the outcome of a scheme for the establishment of a Botanical sub-station at Karnal which was originally sanctioned in 1930. It was now proposed to extend the scheme for a further period of five years at Karnal and later at Pusa, from the date of its termination, viz., September 1935. The sub-station at Karnal was started to provide the Agricultural Research Institute with a station for work under irrigated conditions. When the Agricultural Research Institute itself was to be transferred to the neighbourhood of Delhi under irrigation conditions, it was evident that the sub-station at Karnal, only 70 miles away from Delhi, would not be required. But at the same time the reasons which prevailed, when the Agricultural Research Institute was established on unirrigated land in Bihar, now applied to a sub-station in Bihar for work under un-irrigated conditions. The proposal therefore provided for the continuance of the Botanical sub-station at Karnal until such time as the Research Institute was established at the new site and for the transference of the sub-station to Pusa, whenever the transfer was complete. It was proposed to retain for the Pusa sub-station the Botanical Section and one portion of the farm where the permanent manurial experiments have been in progress for the last 26 years. This would therefore provide for botanical work in North-East India and would, at the same, ensure the continuance of the permanent manurial experiments which it would be a great pity to abandon. As to the land and buildings of the Botanical sub-station at Karnal which were the property of the Government of India, it was intended to use them for part of the Agricultural Section of the new Research Institute. In this way they had provided about 200 acres of land at Karnal which could not otherwise be secured at the new site. In reply to Mr. Morgan, Dr. Shaw stated that the Botanical sub-station at Karnal would not add to the budget provision for the new Research Institute and as to the receipts accruing from the sub-station they were divided between the Government of India and the Council. Mr. Burt supported the proposal and said that the retention of a sub-station at Pusa would ensure continuity of work on two very important crops, viz., Linseed and Tobacco. He drew attention to the Fertiliser Committee's recommendation regarding the continuation of old manurial experiments. Mr. Sethi, in support of the proposal, said that Bihar had been deprived recently of many things and requested that the Council would not deprive them of at least a sub-station of the Imperial Institute of Agricultural Research in that part of the country. The Board recommended the scheme for sanction.

13. *Application from the Director, Imperial Institute of Agricultural Research, Pusa, for a grant of Rs. 29,360 spread over five years for a*

scheme for research on the cytology of Indian crops at Pusa. (Subject No. 7 of the agenda, Appendix XVII).—Dr. Shaw, in introducing the subject, said that many of the members of the Board were familiar with the work which has been done at Pusa since it started and with the results achieved. Those results had yielded great benefit to Indian agriculture and had considerably increased their knowledge of genetics and plant breeding but there was a gap in that knowledge and in the work that had hitherto been done at Pusa because they had never attempted to investigate the cytology of the crops on which they were conducting experiments. In reply to Rao Bahadur Tadulingam, Dr. Shaw stated that he proposed to take up first the cytological investigation of those crops which had been the subject of their plant breeding and genetical research in recent years. In replying to the point raised by Mr. Morgan, Dr. Shaw explained that the training of post-graduate students would be transferred to Delhi but the students of the Botanical Section and of the Agriculture Section would visit the sub-station now at Karnal and later at Pusa at that time of the year which was most suitable for the observation of crops. Mr. Sethi supported the scheme. Mr. Burt also supported the proposal very strongly and said that the scheme did not overlap the scheme of work on the cytology of crop plants (Madras University) either in regard to the general programme of work or the crops which would be studied. Dr. Agharkar said that research on some of the crop-plants was already in progress in his laboratory in Calcutta and enquired whether part of the investigation provided for in the scheme could not be done by them. Dr. Shaw had no objection to the supply to the universities of the seeds of the various varieties of the crops that were being studied to get a knowledge of the chromosome numbers in different crop-plants, but as such crops could only be grown under "pure lines" he felt that the neighbourhood of the Botanical Section of the Imperial Institute of Agricultural Research was more permanently suitable for the carrying out of cytological investigations. The Board recommended the scheme for sanction.

14. *Proceedings of the second meeting of the Fertilisers Committee. (Subject No. 8 on the agenda, Appendix XVIII).*—Mr. Burt in introducing the Report of the Fertilisers' Committee said that the Committee had considered all the data that had been collected in the provinces in the past with the idea of finding out how far there were results of statistical significance on which reliance could be placed. The Fertilizers' Committee had attempted to draw up a programme of fertilisers experiments for the future. If these experiments were to be carried out it was obvious that there should be a certain degree of concentration on definite issues. A properly conducted field experiment however skilfully planned involves the use of a good deal of land and in the case of fertilisers experiments often rendered such land unfit for other experiments for many years to come. The Committee had therefore suggested that there should be a certain amount of concentration in the planning out of fertilisers experiment for the future. After drawing attention to certain important details he then formally moved that the report of the Fertilizers Committee be adopted. After discussion in which several members took part the Board adopted the report.

15. The Chairman then announced the appointment of a Committee to examine and report on the marketing schemes which had been received

from the provinces in response to the request from the Council. The personnel of the committee was as follows :—

Mr. I. D. Mahendra, Marketing Officer, Punjab.

Mr. R. H. Hill, Marketing Officer, Central Provinces.

Mr. K. G. Raju Garu, Marketing Officer, Madras.

Mr. J. A. Manawar, Assistant Deputy Director of Agriculture, Sarda Circle, United Provinces.

Mr. E. J. Bruen, Livestock Expert, Bombay.

Lt.-Col. E. C. Noel, Director of Agriculture, North-West Frontier Province.

Mr. P. B. Richards, Director of Agriculture, United Provinces.

Mr. S. V. Ramamurty, Director of Agriculture, Madras.

Mr. M. Carbery, Assistant Director of Agriculture, Bengal.

Mr. A. McKerrel, Director of Agriculture, Burma.

Mr. T. F. Quirke, Director of Veterinary Services, Punjab.

Khan Bahadur Maulvi Fateh-ud-Din, Director of Agriculture, Punjab.

Mr. J. N. Chakarvarty, Director of Agriculture, Assam.

Mr. D. R. Sethi, Director of Agriculture, Bihar and Orissa.

Dr. V. N. Likhite, Deputy Director of Agriculture, Baroda.

Mr. Ahmed Mohiuddin, Marketing Officer, Hyderabad.

Mr. K. P. Pillai, Director of Agriculture and Fisheries, Travancore.

Mr. K. Achyutamenon, Dewan Peishkar, Cochin.

Mr. H. C. Javaraya, Mysore.

Mr. A. M. Mustafa, Agricultural Officer, Baluchistan.

Mr. S. I. A. Shah, Superintendent, Veterinary Department.

Dr. L. K. Hyder.

16. The meeting then adjourned till 11 o'clock on Wednesday, the 5th September 1934.

BAZLUL KARIM,

for Secretary.

SIMLA,

The 4th September 1934.

Proceedings of the Tenth Meeting of the Advisory Board of the Imperial Council of Agricultural Research held at Simla on Wednesday, the 5th September 1934.

The following were present :—

1. Diwan Bahadur Sir T. Vijaraghavacharya, K.B.E., *Chairman*.
2. Mr. B. K. Badami.
3. Dr. W. Burns.
4. Mr. B. C. Burt.
5. Mr. M. Carbery.
6. Mr. J. N. Chakravarty.
7. Mr. R. T. Davis.
8. Mr. G. K. Devadhar.
9. Mr. T. J. Egan.
10. Mr. E. S. Farbrother.
11. Khan Bahadur Maulvi Fatehuddin.
12. Dr. J. C. Ghosh.
13. Dr. L. K. Hyder.
14. Dr. V. N. Likhite.
15. Mr. A. M. Livingstone.
16. Mr. A. McKerral.
17. Mr. A. M. Mustafa.
18. Mr. Nizamuddin Hyder.
19. Lt.-Col. E. Noel.
20. Col. A. Olver.
21. Mr. T. F. Quirke.
22. Mr. S. V. Ramamurty.
23. Mr. P. B. Richards.
24. Mr. J. H. Ritchie.
25. Mr. C. V. Sane.
26. Mr. P. T. Saunders.
27. Mr. D. R. Sethi.
28. Mr. S. I. A. Shah.
29. Dr. F. J. F. Shaw.
30. Rao Bahadur C. Tadulingam.
31. Mr. G. T. Tait.
32. Mr. W. Taylor.
33. Mr. C. G. Trevor.

The following attended as visitors :—

1. Dr. S. P. Agharkar.
2. Mr. D. Bal.
3. Dr. J. K. Basu.
4. Mr. E. J. Bruen.
5. Mr. A. P. Cliff.

6. Mr. L. F. Cocks.
7. Mr. R. H. Hill.
8. Mr. C. K. Inamdar.
9. Mr. S. N. A. Jafri.
10. Mr. H. C. Javaraya.
11. Mr. P. G. Krishna.
12. Dr. P. E. Lander.
13. Dr. K. C. Mehta.
14. Mr. K. A. Menon.
15. Mr. I. D. Mohendra.
16. Mr. A. Mohiuddin.
17. Mr. G. Morgan.
18. Mr. John A. Munawar.
19. Mr. Nurul Islam.
20. Dr. B. C. Pal.
21. Professor P. K. Parija.
22. Mr. K. P. Pillai.
23. Mr. K. S. Sankaran Pillai.
24. Mr. K. G. Raju.
25. Mr. T. S. Sabnis.
26. Dr. K. C. Sen.
27. Mr. M. Vaidyanathan.
28. Rao Bahadur B. Viswanath.

In the absence of Rai Sahib Malik Charan Das, Mr. Bazlul Karim acted as Secretary.

2. The meeting commenced at 11 A.M. and adjourned at 1-15 P.M. to enable the Fruit Committee the Progress Report Committee and the judging Committee for the award of medals to meet in the afternoon.

3. *Recommendations of the Crop Planning Sub-Committee of the Advisory Board of the Imperial Council of Agricultural Research, June 1934. (Subject No. 14 on the agenda, Appendix XIX).*—The Chairman at the outset explained the circumstances under which he appointed a sub-committee of the Advisory Board in connection with the Crop Planning Conference and requested the Board to approve the action taken by him. The Board approved the action of the Chairman.

Mr. McKerral drew attention to one of the recommendations of the Crop Planning Conference regarding rice, *viz.*, that the Government of India should consider whether the specific duty imposed by the Ottawa agreement on the imports of rice from foreign countries to the United Kingdom should be extended on paddy to the extent of 3 farthings per lb. He said that this matter was very important to two provinces, *viz.*, Bengal and Burma. The Crop Planning Conference had discussed this matter from the point of view of trade and the agriculture of India in general. He was of the opinion that the Imperial Council of Agricultural Research should examine the question in its bearings on the sanctioned schemes of rice research now in operation. Two or three years ago the Empire Marketing Board and the Imperial Council of Agricultural Research made

large grants for rice research on the express condition that the Agricultural Departments in Bengal and Burma should evolve types of rice suitable for the quality trade in United Kingdom. So far as Burma was concerned they had largely succeeded as, even before they got a grant from the Council, they were engaged in producing types of rice which would some day capture the European market. These markets were supplied from America, Italy and Spain, and the export trade of those countries was highly subsidised by their Governments. The United Kingdom market was a small market, but it was a very important one. It would be of great advantage to India if they could capture that market, firstly because of the high price paid and secondly because it would relieve the pressure of outside competition with Indian rice which was becoming greater from year to year. With the implementing of the Ottawa agreement in 1933 Burma had got the opportunity of capturing the London market. Mr. McKerral took the opportunity to contradict several mis-statements which had appeared in the Press from time to time that Burma and Bengal could not produce types of rice suitable for the United Kingdom market. Had the specific duty imposed by the Ottawa agreement on imports of rice from foreign countries to the United Kingdom extended to paddy, India would have by now or by next year captured a large part of the United Kingdom market. Foreign countries were taking advantage of the difference in the duties on rice and paddy and as an instance he cited the erection of a mill financed by German capital on the River Thames in London where large quantities of paddy imported from Spain were milled. Owing to this foreign competition the exports of high grade rice from Burma to the United Kingdom in 1934 were negligible and the research schemes financed by the Empire Marketing Board and the Imperial Council of Agricultural Research would lose a great part of their value if this state of affairs were allowed to continue. He therefore suggested that it would be extremely useful if the Council as a Council of Research would ratify the findings of the Crop planning Conference and make a similar recommendation. Mr. McKerral then moved the following resolution :—

“ That in view of the fact that the grants received from the Empire Marketing Board for rice research schemes in Bengal and Burma were expressly given for the production of rices suitable for the United Kingdom market and that this market is now becoming closed to the improved Indian rices which have been proved suitable for it owing to foreign paddy escaping the specific duty imposed on foreign rice imported into the United Kingdom and that as the research schemes referred to are on this account likely to be rendered fruitless, the Council desires to confirm the opinion expressed by the recent Indian Crop Planning Conference that early steps be taken to impose a specific duty of at least *three farthings* per pound on all foreign paddy imported into the United Kingdom.”

Mr. Carbery seconded the resolution and said that if given a chance, Bengal would be able to compete with foreign countries. He pointed out that Bengal's export rices were drawn mainly from the non-jute-growing areas. Mr. Burt had every sympathy with the object of the resolution for the reason stated by Mr. McKerral, but he would not go as far as the

wording of the resolution. When the rice research schemes were sanctioned there was no preference on rice in the United Kingdom market. Indian and Burma rice always held a certain position in the United Kingdom market on its merits mainly on the score of price. He therefore suggested that the resolution be amended to read as follows :—

Resolution as approved.

“ That in view of the fact that the grants received from the Empire Marketing Board for Rice Research schemes in Bengal and Burma were expressly given for the production of rices equal to the highest quality required in the United Kingdom market and the fact that the omission of foreign paddy from the specific duty gravely reduces the value of the Ottawa Preference on Empire Rice, the Council desires to endorse the opinion expressed by the recent Indian Crop Planning Conference that His Majesty's Government should be requested, at an early date, to impose a specific duty of *three farthings* per pound on all foreign paddy imported into the United Kingdom.”

The amended resolution was accepted by Mr. McKerrall and carried unanimously.

4. *Application from the Andhra University for a grant of Rs. 5,000 spread over a period of two years for a scheme to investigate the commercial production of Sweet Potato Starch by Dr. D. G. Walawalkar, B. Ag., M.Sc., Head of the Department of Technology, Andhra. (Subject No. 53 of the agenda, Appendix XX).*—Mr. Ramamurty said that he had received a report from the Agricultural Chemist, Madras, that considerable work had been done on the subject in the United States and that the colouring matter could be removed by the use of sulphur dioxide. He therefore suggested that the scheme should be returned to the Andhra University and may be asked what they had to say in view of the report of the Agricultural Chemist. Dr. Burns said that the scheme was vaguely worded and should be rejected summarily. Mr. Ramamurty said that in view of the procedure followed in fostering the idea of co-operation between the Council and the Universities it would be desirable to point out to the University the method of submitting a scheme for consideration of the Council as the University was not aware of it. Dr. Agharkar agreed with Mr. Ramamurty. After some discussion the matter was put to the vote and the Board rejected the scheme by a majority.

5. *Progress made in the preparation of Statistical notes on the technique of field experiments by the Statistician to the Imperial Council of Agricultural Research. (Subject No. 60 of the agenda, Appendix XXI).*—After Mr. Vaidyanathan had spoken, Dr. Burns said that at the Padegaon Research Station research workers used to meet at times to discuss scientific matters and scientific visitors were asked to address. Mr. Vaidyanathan addressed the research workers last year and his address has been written up. It was for the Council to consider whether it should be published in one of its journals. Mr. Burt agreed with Dr. Burns and said that Mr. Vaidyanathan's papers might well be put in a form suitable for publication either in the Indian Journal of Agricultural Science or Agriculture and Livestock as the editorial committee considered appropriate. Dr. Shaw

said that training in statistical work had always been an important part of the post-graduate course at Pusa and the lectures which had been given during that course were now reduced to book form and were ready to be published as a text book of Statistics for agricultural workers.

The Secretary's note was recorded.

6. *Printing of Progress Reports on Research Schemes.* (Subject No. 61 on the agenda, Appendix XXII).—Mr. Burt referred to the suggestions put forward in the Secretary's note and said that the time had now come when the Advisory Board might consider the Procedure which should be adopted in regard to the printing of progress reports on research schemes. Hitherto they had abstained from laying down any rules in order to gain experience, but the consideration of progress reports was now an important part of the Board's work. It was a matter of some difficulty to get reports printed up in time. Moreover a certain amount of latitude should be given to the Provinces in the matter of the annual reports. It was accordingly suggested that the Local Government or the Universities concerned should print the reports themselves. The representatives of the Inter-University Board and the Directors of Agriculture did not agree with this proposal and added that if the printing was to be done by them they would be forced to approach the Council for funds to meet the cost of printing. It was agreed that the Council should get annual reports printed as at present but that the rules laid down by the Council regarding illustrations and the preparation of manuscripts to the press (standing instructions for authors) should be followed. It was also agreed that copies of those illustrations and graphs which were not printed should be circulated only to the members of the relevant sub-committees.

7. *Application from the Government of Bengal for a grant of Rs. 5,000 spread over two years for a scheme for investigating the Biology Anatomy, and development of pulse beetles (Bruchidae), with special reference to remedial measures against these pests by Mr. D. D. Mukherji, Lecturer in Zoology, University College of Science and Technology, Calcutta.* (Subject No. 62 on the agenda, Appendix XXIII).—After Mr. Carbery had introduced the scheme Mr. Richards referred to the work on pulse beetles already published from Pusa which appears to have been overlooked. He doubted whether any practical results would be derived from the proposed investigation. It was the sort of subject that should be undertaken at the Imperial Institute of Agricultural Research by Post-graduate students if it were undertaken at all. He feared that nothing would come out of the scheme beyond material for a scientific Research.

Mr. Burt referred to the note of Mr. P. V. Isaac circulated to the members and said that he was not convinced that from an economic point of view there was any need for further work on the lines proposed. There was a need for practical experiments on the storage of pulses. Dr. Agharkar said that Dr. Mukherjee was proposing to study the life history of insect parasite of the pest including the embryonic development. He was of the opinion that the scheme was a very modest one and that the Bengal Government and the Calcutta University have given sufficient help and facility and that the Council would be well advised to lend its helping hand. Mr. McKerral opposed the scheme and said that he had his doubts as to

whether it would be of direct interest to the practical agriculturist. The Board rejected the scheme.

8. *Adoption of measures to prevent the further spread of San Jose Scale, a serious fruit pest in India.* (Subject No. 63 on the agenda, Appendices XXIV and XXIV-A).—After Mr. Burt had explained what had been done since the Board considered the question in 1933, Mr. Richards said that there was a serious danger of this pest entering the United Provinces from the infected areas to the north-west of the Province and it was extremely important to protect the local fruit-growers and the fruit industry in the Kumaon hills. It was now high time that they took steps to restrict exports of any growing materials from the affected areas. He would not however recommend that any restriction should be put on the export of fruit from the affected areas, because in his opinion that was quite impracticable. He added that a certain amount of risk of the pest spreading was there, but that risk had to be taken. Efforts should be concentrated on stopping the movement of living plants from affected areas. Mr. Ritchie referred to the report of the Central Provinces Entomologist and said that at present the pest was not found in the Provinces. It was however feared that there was a chance of the disease appearing in the plateau districts of the Province and they wished to guard against this contingency by recommending the prohibition of export from infected areas without a certificate of fumigation. There was then a general discussion on the subject in which many members took part. The sense of the Board was that some action should be taken to prevent the spread of the pest. The question whether exports or imports of living plants should be regulated was discussed at some length. At this stage Mr. Burt moved the following resolution :—

“ That the legal aspect and practical feasibility of prohibiting or regulating the import into specified areas of living trees capable of carrying San Jose Scale be investigated and a report made to the next meeting of the Board.”

The Board adopted the resolution.

9. *Application from the Government of Bengal for a grant of Rs. 43,152 spread over three years for a Scheme of research work on the Physiology of the rice plant by Dr. S. P. Agharkar of the Calcutta University, Appendix XXVI.*—

Scheme from the Government of Madras for an investigation into the quality of rice.—Appendix XXVII.

Progress report for the year 1933-34 on the scheme of research work on rice physiology by Dr. R. H. Dastur, Royal Institute of Science, Bombay.—Appendix XXVIII.

Application from the Government of Bengal for a grant of Rs. 21,600 spread over five years for a scheme of research on the bio-chemical and physio-chemical properties of rice at the bio-chemical laboratory of the Dacca University.—Appendix XXIX.

Scheme from the Government of Bihar and Orissa for research on the quality of rice.—Appendix XXX.

Application from the Government of the Central Provinces for a grant of Rs. 10,088 spread over four years for research work on the

"gangai" pest of rice—Entomological work under the scheme of rice research already sanctioned by the Council for the Central Provinces. Appendix XXXI. (Subject Nos. 24, 28, 29, 30, 31, and 32 of the Agenda).—The Chairman introduced the report (Appendix XXV) of the sub-committee appointed to consider the rice research schemes and rice progress reports. Dr. Burns took exception to the wording of the sub-committee's report in regard to part I of the scheme. He desired to emphasise that the sub-committee had rejected the whole scheme. Mr. Burt said that the decision not to sanction any part of the scheme was taken by a majority of votes (7 against 5). The decision not to sanction part II was unanimous. Dr. Agharkar was then called upon by the Chairman to explain his scheme. Dr. Agharkar accepted the decision of the committee in respect of Part II of the scheme but emphasised the importance of Part I of the investigation and appealed to the Board to recommend the scheme for sanction. Dr. Ghosh supported Dr. Agharkar. The Board however was not convinced of the necessity of the scheme and adopted the recommendation of the sub-committee.

The report of the sub-committee on items Nos. 28, 29, 30, 31 and 32 (Appendix XXV) was adopted by the Board.

10. The meeting then adjourned till 11 o'clock on Thursday, the 6th September 1934.

Proceedings of the Tenth Meeting of the Advisory Board of the Imperial Council of Agricultural Research held at Simla on Thursday, the 6th September 1934.

The following were present :—

1. Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E.,
Chairman.
2. Dr. B. K. Badami.
3. Rao Bahadur Bhimbhai R. Naik.
4. Dr. W. Burns.
5. Mr. B. C. Burt.
6. Mr. M. Carbery.
7. Mr. J. N. Chakravarty.
8. Mr. R. T. Davis.
9. Mr. G. K. Devadhar.
10. Mr. T. J. Egan.
11. Khan Bahadur Maulvi Fatchuddin.
12. Dr. J. C. Ghosh.
13. Dr. L. K. Hyder.
14. Dr. V. N. Likhite.
15. Mr. A. M. Livingstone.
16. Mr. A. McKerral.
17. Brigadier H. S. Mosley.
18. Mr. A. M. Mustafa.
19. Mr. Nizamuddin Hyder.
20. Lt.-Col. E. Noel.
21. Colonel A. Olver.



22. Mr. T. F. Quirke.
23. Mr. S. V. Ramamurty.
24. Mr. P. B. Richards.
25. Mr. J. H. Ritchie.
26. Mr. C. V. Sane.
27. Mr. P. T. Saunders.
28. Mr. D. R. Sethi.
29. Mr. S. I. A. Shah.
30. Dr. F. J. F. Shaw.
31. Rao Bahadur C. Tadulingam.
32. Mr. G. T. Tait.
33. Mr. W. Taylor.
34. Mr. C. G. Trevor.

The following attended as visitors :—

1. Dr. S. P. Agharkar.
2. Mr. D. Bal.
3. Mr. J. K. Basu.
4. Mr. E. J. Bruen.
5. Mr. A. P. Cliff.
6. Mr. J. R. Haddow.
7. Mr. R. H. Hill.
8. Mr. C. K. Inamdar.
9. Mr. S. N. A. Jafri.
10. Mr. H. C. Javaraya.
11. Mr. P. G. Krishna.
12. Dr. P. E. Lander.
13. Dr. K. C. Mehta.
14. Professor J. H. Mitter.
15. Mr. I. D. Mohendra.
16. Mr. A. Mohiuddin.
17. Mr. G. Morgan.
18. Mr. John A. Munawar.
19. Mr. Nurul Islam.
20. Dr. B. C. Pal.
21. Professor P. K. Parija.
22. Dr. B. S. Patil.
23. Mr. K. P. Pillai.
24. Mr. K. G. Raju.
25. Mr. J. Ramsay Scott.
26. Mr. T. S. Sabnis.
27. Dr. K. C. Sen.
28. Mr. M. Vaidyanathan.
29. Rao Bahadur B. Viswanath.

In the absence of Rai Sahib Malik Charan Das, Mr. Bazlul Karim acted as Secretary.

2. The meeting commenced at 11 A.M. and adjourned at 12-30 P.M. to enable the Marketing Committee, the Soil Science Committee and the Sunn-Hemp Committee to meet in the afternoon.

3. *Recommendations of the Tobacco Sub-Committee of the Advisory Board of the Imperial Council of Agricultural Research.* (Subject No. 34 of the agenda, Appendix XXXII).—Mr. Burt explained in detail the various recommendations of the Tobacco Sub-Committee and formally moved that the portion of the Sub-Committee's Report which dealt with items 1 to 3 of the agenda (Appendix XXXII-A.) of the Committee be adopted. The Chairman made it clear that members were asked to vote upon two proposals, viz. :—

- (i) that the sanction to the scheme for a cigar tobacco expert for Madras and Bengal should be withdrawn, and
- (ii) that a sub-station of the Pusa Research Institute should be opened at Guntur for research on cigarette tobacco. As regards (i) it was explained that the centre of gravity had shifted from cigar tobacco to cigarette tobacco and the provinces concerned did not want the cigar tobacco expert. As to (ii) Guntur was a central place in India for research work of this nature. Mr. Ritchie said that in 1916 the area under tobacco in the Central Provinces was 32,000 acres and it had fallen to about 17,000 acres in 1933. He was not aware of the reason for this fall but he left that the acreage would recover to the original figure and possibly increase. He therefore requested the Board to include the Central Provinces and Berar in the programme of experimental work proposed by the Committee. Mr. Nizamuddin Hyder requested that Hyderabad State might also be included in the co-operative programme in view of the fact that there were 75,000 acres in the State under tobacco. Col. Noel and Mr. Javariah put forward proposals that the N.-W. F. P. and Mysore be included in the co-operative programme of experiments. Dr. Shaw said that the question of placing experimental curing barns in the N.-W. F. P. and in Mysore should be investigated as there was a doubt as to the suitability of the climate of N.-W. F. P. for growing cigarette tobacco and of the fact that the Indian Leaf Tobacco Development Co. had once made considerable purchases of leaf near Bangalore but subsequently closed their depot. Mr. Richards was doubtful whether the United Provinces Government would be able to meet the working expenses of the barns and of the staff required in that connection. He therefore requested that the matter might be left open as to whether or not Local Governments could come up to the Council for additional financial assistance in regard to the necessary staff for carrying out the proposed experiments. The Chairman explained that the Tobacco Sub-Committee's recommendation was on the distinct understanding that the recurring expenditure connected with the programme would be met by the

Local Governments and if a Local Government did not accept this it would show that they were not very keen about the extension of cigarette tobacco. If any Local Government really found it difficult to meet the charge from its own budget then it could come to the Council for financial assistance and their proposals would be referred to the Tobacco Committee and the Board ; this would mean a delay of a year. In answer to Dr. Burns the Chairman replied that if the research programme was approved by the Governing Body there was a likelihood of the funds being allotted in January next from the reserve which was held against the original scheme for a cigar tobacco expert. The Chairman then put the following recommendations to the vote :—

- (i) that the sanction given to the scheme for a cigar tobacco expert for Madras and Bengal (to which funds had not yet been allotted) be withdrawn ;
- (ii) that a Central Sub-Station of the Imperial Institute of Agricultural Research, be established at Guntur in the Madras Presidency ;
- (iii) that a pair of flue-curing barns at a cost of about Rs. 2,500 be provided for the following provinces :—
Punjab, Bombay Bihar (Sabour), Burma, Bengal, United Provinces, Central Provinces, Hyderabad and one at Baroda ; and
- (iv) that the question whether these experiments should be extended to the N.-W. F. P. and Mysore be investigated by Col. Noel and Mr. Javariah respectively in consultation with Dr. Shaw.

The recommendations were carried.

Mr. Burt then introduced the recommendations of the Sub-Committee on items Nos. 4, 5, 6 and 7 and said that the Sub-Committee had greatly appreciated the valuable help rendered by the trade representatives. The Sub-Committee considered that any direct extension work should be undertaken only after the results of the co-operative experiments were received and in the meantime extension work should be left to private enterprise. The next question considered by the Committee was whether we could furnish more detailed statistics of those types of tobacco which were acceptable on the European market and especially in the United Kingdom where we had a very valuable trade. The members of the committee had given a certain amount of information and Mr. Burt had promised to follow up the matter in the light of that information. It was thought that if special statistics could be obtained for those districts which produced the types of tobacco which were exported or were suitable for export, it would be great help to the trade in Indian tobacco. The Indian Trade Commissioner attached considerable importance to the furnishing of better information of this nature. The committee had then considered the proposal for the appointment of a Central Tobacco Committee which had been made at the Provincial Economic Conference. The opinion of the Sub-Committee on this point was that there was no necessity for Central Tobacco Committee of the nature proposed until the results of research schemes now recom-

mended were forthcoming and it would be sufficient to retain an advisory sub-committee of the Council as existed at present. The Chairman then moved that the report of the Tobacco Committee on items Nos. 4, 5 and 6 of their agenda (Appendix XXXII-A) be adopted. The Board adopted the report (Appendix XXXII).

4. *Application from the Andhra University for a grant of Rs. 1,000 for a scheme to find out the best method of extracting Nicotine commercially from tobacco waste and to design an apparatus for the same. (Subject No. 35 of the agenda, Appendix XXXIII).*—Mr. Burt explained that the Tobacco Committee which had considered this scheme was informed that some experimental work on these lines was being carried out by the Industrial Chemist, Bombay. The Committee had therefore recommended that the Bombay Industries Department should be requested to supply any information available and that the application be further considered at a future meeting. The Board adopted the recommendation of the Committee.

5. *Application from Mr. J. J. Devalois, Principal, American Arcot mission, Agriculture Institute, Katpadi, Madras, for a grant of Rs. 78,876 for goat breeding in the Madras Presidency spread over a period of 10 years. (Subject No. 22 of the agenda, Appendix XXXIV).*—Mr. Ramamurty said that the Standing Cattle Breeding Committee had considered this scheme and recommended that it be revised in the light of the remarks made by the Committee. He undertook to ask Mr. DeValois to revise the scheme accordingly. The Chairman then put the recommendation of the Committee to vote which was carried.

6. *Application from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 15,864 spread over three years for a scheme to investigate the preparation of eggs for marketing and other methods of disposal. (Subject No. 25 of the agenda Appendix XXXV).*—Colonel Oliver introduced the report of the Cattle Breeding Committee on this subject and said that the scheme was considered by a sub-committee of the Board and the Board in February 1934 with the result that it was returned to the United Provinces Poultry Association for revision. Since the revised scheme was received the position had altered by the institution of a Marketing Section of the Council. The Marketing Section would deal with a greater portion of the scheme. The Committee therefore recommended that a fresh scheme should be prepared by the Director of Veterinary Services, United Provinces, for the Poultry Association to work in collaboration with the Harcourt Butler Technological Institute to deal with the problems connected with the collection, storing and disposal of eggs and powder which would not be part of the work of the Marketing Staff. Mr. Nur-ul-Islam accepted that the scheme did contain some points connected with the marketing of eggs but he wanted clearer instructions for the preparation of a fresh scheme than were given by the Committee. He then pointed out that the Association could not supply sterile eggs free of cost and this was why a provision of Rs. 500 per annum had been made in the scheme. Mr. Nur-ul-Islam then moved that the following portion of the Committee's report be deleted :—

“Item No. 4—United Provinces Poultry Scheme, page 1 of the Report, lines 7 to 9—Research work was necessary to study

the best methods of testing, grading, packing and transporting eggs under Indian conditions and."

Mr. Egan said that it would be necessary to provide material for research at the Harcourt Butler Technological Institute at Cawnpore. The Institute could not supply sterile eggs and unless a small grant was sanctioned for the purpose it was not possible for the Institute to carry on the research. Mr. Bruen proposed that the words "packing and transporting eggs" be changed into "packing for transport of eggs". He also added that the United Provinces Poultry Association should supply the sterile eggs by having poultry on their farm and not purchase them. The scheme should be prepared in the best method for storing and packing eggs. In replying to Mr. Nur-ul-Islam's objections Colonel Olver explained that what the Committee proposed to cut out was the work which dealt with marketing aspects of the scheme as it was considered that this work would be done by the marketing staff. On the other hand it was definitely agreed that research work was necessary to study the best methods of testing, grading, packing eggs for transportation under Indian conditions and that work should be continued on the preparation of egg-powder and egg pulp. To carry on this work it was necessary to have a supply of sterile eggs which were known to be fresh. Mr. Nur-ul-Islam had stated that he could not supply them from the Association and it was therefore necessary to make provision for this in the scheme. The Committee had also recommended to omit that portion of the scheme which involved travelling about the country. Mr. Quirke agreed with Colonel Olver. Mr. Livingstone said that there were four points in the scheme, viz. :—

- (a) study of indigenous methods of producing eggs ;
- (b) study of the question of organised collection ;
- (c) study of methods of testing, grading and standardisation ; and
- (d) study of the work done by the Association in regard to storage, preservation and packing of eggs.

The first three concerned the marketing staff and the Committee had therefore recommended that they be left out of the scheme. The fourth point was for the Association to take up and therefore the Committee had recommended that a fresh scheme be prepared in the light of the remarks offered by it.

The Chairman then summed up the discussion on the subject and put the amendment of Mr. Nur-ul-Islam before the Board. The amendment fell through for want of a seconder. The amendment of Mr. Bruen was accepted by the Board. The report of the Standing Cattle Breeding Committee on the subject was then adopted by the Board.

7. *Application from the Government of Madras for a grant of Rs. 37,580 spread over a period of ten years for sheep breeding research in Madras. (Subject No. 26 of the agenda, Appendix XXXVI).*—Mr. Ramamurty moved that the recommendation of the Standing Cattle Breeding Committee to accept this scheme be adopted and this was agreed to by the Board.

8. *Application from the Government of Hyderabad for a grant of Rs. 77,960 spread over a period of 10 years for a scheme of research in*

sheep breeding. (Subject No. 27 of the agenda, Appendix XXXVII).—Dr. Badami said that the Hyderabad State was the next most important province after Madras in the importance of sheep breeding industry. A fairly large quantity of wool was produced, most of which was used locally while the rest was exported to the woollen mills in Bangalore and to northern India. But the amount of wool produced per sheep was very small and the quality of wool also very poor. It was therefore desirable to make an attempt to increase the quantity of wool and to improve its quality. The Hyderabad Government had two or three years back sanctioned a proposal to start a sheep breeding farm in the State for these purposes but had since been held up for want of funds. Though the State could go on with their scheme to a certain extent, it was considered most desirable to be associated with the Council and to form a link in the chain proposed by the Advisory Board last year under which there was to be a co-ordinated scheme of research in sheep breeding extending from Baluchistan to Madras. The scheme had been prepared on the model of the Bombay scheme already sanctioned by the Advisory Board and on the kind advice of the Animal Husbandry Expert to the Council. Referring to the report of the Standing Cattle Breeding Committee which had examined this scheme, Dr. Badami said that in preparing the scheme the Director of Agriculture, Hyderabad, had followed the Bombay scheme step by step and he saw no reason why an objection should be raised to the buildings provided for by him when there was a provision for the same in the Bombay scheme. He thought that the scheme was a modest one and might be accepted by the Board. If, however, the Board could not, for any reason, accept the present scheme, the revised scheme, which had been prepared in the light of the recommendations of the Sub-Committee, might be considered. Mr. Ramsay Scott said that India exported wool to the value of about two crores and this amount would be doubled if the quantity of wool was increased and the quality improved. The scheme was therefore an important one and all such schemes should be financed by the Council. He also suggested that the Council should arrange to send a man round India so that he would be able to advise those in charge of the schemes on the spot. Mr. Ramsay Scott however thought that the present scheme seemed to have been turned down on account of lack of knowledge in sheep breeding. If that was so, the Council should tell people what sort of schemes they should put up. Mr. Bruen said that they were not turning down the Hyderabad scheme. They had only asked that it should be taken back and a fresh scheme submitted as the Committee was not impressed with the way in which it had been prepared. It seemed as if there was nobody in the State who had special knowledge of sheep. He therefore suggested that definite provision should be made by the Hyderabad Government to entrust the control of all sheep-breeding work to an expert in live-stock work. Mr. Bruen thought that, in fairness to the Cattle Breeding Committee which consisted of the members who were supposed to know something about sheep breeding, the recommendation of that Committee should be accepted. Mr. Trevor said that he was speaking not as a Forest Officer but as a sheep breeder who ran a sheep farm in Wales. Naturally therefore he had every possible sympathy with sheep and the improvement of sheep. He had been associated nearly all his life with the sheep industry but looking at this scheme from the point of view of a practical farmer he had noticed many things in the

scheme which should not be there. For instance, there was a provision of about Rs. 4,000 for shelters. His sheep were out in the open in the Welsh mountains and valleys during summer and winter and they were never in a shed at all except when shearing was going on. Coming to staff, he said that a large number of men were to be employed. He could not understand what they were going to do. His sheep were looked after by one man who, in addition, looked after 50 heads of cattle and did a lot of other things. However sympathetic the Board might be to the sheep breeders, the present scheme involved expenditure and labour of a nature which should not be accepted by the Board. As to the revised scheme which the Director of Agriculture, Hyderabad, had prepared in so short a time on the recommendation of the Committee, he had not seen it and could not therefore offer his criticisms on it. Mr. Ramsay Scott enquired why the Punjab Government had not put up a scheme. Mr. Quirke replied that a good deal was being done for the improvement of sheep breeding in the Punjab, especially on the Hissar Farm. The finances of the Hissar Farm were at present under examination by the Local Government and until the future activities of the farm were finally decided upon he did not feel justified in adding to its commitments by proposing further schemes to be carried out on the farm. Mr. Quirke would extend an invitation to Mr. Ramsay Scott to visit the farm at an early date. Colonel Olver said that he was very anxious to get schemes of sheep breeding approved by the Board but the present scheme did not seem to him to be of a practical nature inasmuch as he was not aware of sheep being anywhere bred under the conditions put forward in the scheme. Dr. Badami here again made a reference to the provision of sheds in the Bombay scheme upon which the Chairman called upon Dr. Burns to state the facts. Dr. Burns said that there was no provision for housing the sheep in the Bombay scheme. The tin houses that were provided for in the scheme were for shepherds and servants. There was a shearing shed for sheep and nothing beyond that. The Chairman summed up the discussion on the subject and said that to him there seemed to be no material difference of opinion on the substance of the report between the members of the Standing Cattle Breeding Committee and the Hyderabad representatives. The Committee considered the scheme too expensive in the matter of staff buildings and provision for feeding and had recommended that it should be withdrawn and a fresh scheme prepared. In the light of the remarks of the Committee, Dr. Badami had with commendable promptitude revised the scheme. It was therefore obvious that he had accepted the recommendation of the Committee in this respect. The second point in the Committee's report to which exception was taken was the recommendation that definite provision was necessary for the control of the work by an expert in live-stock work. Dr. Badami had himself stated that there was no live-stock expert in Hyderabad and that there was no chance of one being appointed in the near future. Though it was not proposed to withhold sanction to the scheme till an expert was appointed, yet the Hyderabad Government must naturally make some arrangement for the supervision of the scheme and that was all that the Committee's report had suggested. Obviously the Committee had no intention of dictating to anybody in this matter. Nothing would be lost by considering the revised scheme at the next meeting of the Board, since there was no likelihood of funds being allotted immediately to the schemes that might be approved by the Board at their present meeting or the next meeting. If Dr. Badami was anxious to push

forward with the revised scheme, that he had now produced the only thing for him to do was to hand it over to the office with a promise to send the usual 100 printed copies through his Government. The scheme will then be placed before the Standing Cattle Breeding Committee for examination and report to the next meeting of the Board. The Chairman then moved that in the light of this explanation the report of the sub-committee on the subject be adopted. The Board adopted the report.

9. *Progress Reports on Veterinary Research Scheme sanctioned by the Imperial Council of Agricultural Research—(vii) Annual Report of Dr. A. E. Slater's goat-breeding scheme for the year 1933-34. [Subject No. 36 (vi) of the agenda, Appendix XXXVIII].*—The Board adopted the report of the Standing Cattle Breeding Committee on the subject.

10. *Application from the Government of Bengal for a supplementary grant of Rs. 15,571 in connection with the appointment of a Physiological Chemist to study Animal Nutrition problems at Dacca. (Subject No. 33 of the agenda, Appendix XXXIX).*—The Standing Nutrition Committee which had examined this scheme thought that the work that was being done was of value and much required in India. The Committee therefore recommended that the extra provision asked for should be made. The Board adopted the recommendation of the Committee.

The meeting then adjourned till 11 o'clock on Friday, the 7th September 1934.

BAZLUL KARIM,
for Secretary.

SIMLA :

The 6th September 1934.

Proceedings of the Tenth Meeting of the Advisory Board of the Imperial Council of Agricultural Research held at Simla on Friday, the 7th September 1934.

The following were present :—

1. Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E.,
Chairman.
2. Dr. B. K. Badami.
3. Dr. W. Burns.
4. Mr. B. C. Burt.
5. Mr. M. Carbery.
6. Mr. J. N. Chakravarty.
7. Mr. R. T. Davis.
8. Mr. G. K. Devadhar.
9. Mr. T. J. Egan.
10. Mr. E. S. Farbrother.
11. Khan Bahadur Maulvi Fatehuddin.
12. Dr. J. C. Ghosh.
13. Dr. L. K. Hyder.
14. Dr. V. N. Likhite.

15. Mr. A. M. Livingstone.
16. Mr. A. McKerral.
17. Brigadier H. S. Mosley.
18. Mr. A. M. Mustafa.
19. Rao Bahadur B. R. Naik.
20. Mr. Nizamuddin Hyder.
21. Lt.-Col. E. Noel.
22. Colonel A. Olver.
23. Mr. T. F. Quirke.
24. Mr. S. V. Ramamurty.
25. Mr. P. B. Richards.
26. Mr. J. H. Ritchie.
27. Mr. C. V. Sane.
28. Mr. P. T. Saunders.
29. Mr. D. R. Sethi.
30. Dr. F. J. F. Shaw.
31. Rao Bahadur C. Tadulingam
32. Mr. G. T. Tait.
33. Mr. W. Taylor.
34. Mr. C. G. Trevor.
35. Mr. S. J. A. Shah.

The following attended as visitors :—

1. Dr. S. P. Agharkar.
2. Mr. D. V. Bal.
3. Dr. J. K. Basu.
4. Mr. E. J. Bruen.
5. Mr. A. P. Cliff.
6. Mr. L. F. Cocks.
7. Mr. R. H. Hill.
8. Mr. C. K. Inamdar.
9. Mr. S. N. A. Jafri.
10. Mr. H. C. Javaraya.
11. Mr. P. G. Krishna.
12. Dr. K. C. Mehta.
13. Mr. K. A. Meron.
14. Professor J. H. Mitter.
15. Mr. I. D. Mohendra.
16. Mr. A. Mohiuddin.
17. Mr. G. Morgan.
18. Mr. John A. Munawar.
19. Mr. Nurul Islam.
20. Dr. B. C. Pal.
21. Professor P. K. Parija.
22. Mr. K. P. Pillai.

23. Mr. K. G. Raju.
24. Mr. T. S. Sabnis.
25. Dr. K. C. Sen.
26. Mr. M. Vaidyanathan.
27. Rao Bahadur B. Viswanath.

In the absence of Rai Sahib Malik Charan Das, Mr. Bazlul Karim acted as Secretary.

2. The meeting commenced at 11 A.M. and adjourned at 1-10 P.M. to enable the Rust Research Committee and the Potato Committee to meet in the afternoon.

3. *The Report on Coconut Enquiry by Dr. Patel. (Subject No. 4 on the agenda, Appendix XI).*—Mr. Burt introduced the report of Dr. Patel who was appointed by the Council as a whole-time officer to conduct an enquiry into the supply of coconut products and coconut oil in India in order that the real facts of the position in South India might be ascertained. He said that he would first place two routine matters before the Board, viz., (i) the authorisation by the Board of the publication of the Report and (ii) a proposal that the Report be referred to the Indian Oil Crushing Industry Committee of the Council for examination of the numerous practical items of information which have been brought out in the Report. Dr. Patel's enquiry was essentially a fact-finding enquiry and in his opinion Dr. Patel had carried out the task with great industry and ability and had collected a considerable volume of valuable information under very difficult conditions. As the members of the Board are aware it is very difficult to get accurate estimates of coconut production and Dr. Patel had explained the methods adopted by him to arrive at the figures put forward in the Report. Mr. Burt then referred to the summary of conclusions on pages 143 to 147 of the Report and said that the question of tariffs was a complicated one and concerned the Commerce Department of the Government of India. He would not therefore touch on that matter. To his mind the most urgent need was to improve the efficiency of coconut and copra production and marketing. It was quite clear that there was a great need for improving the efficiency of the coconut oil industry in South India but there was even greater need for improving the efficiency of copra production and marketing in order that the grower might get a larger share of the price paid by the consumer. Coconut oil was only one of a number of vegetable oils which could mutually replace each other in industry to a considerable extent. It was not a commodity like sugar where one could protect a single product and go ahead. Coconut oil could be replaced for many purposes in the preparation of vegetable products by the hydrogenisation of groundnut oil. Coconut oil had certain advantages and at a competitive price coconut oil would be preferred if the supplies were regular, but if the price of this oil went up there was a turn-over in favour of groundnut oil. Indian prices of groundnut oil were governed by world prices, just as were the Ceylon prices of coconut oil, because India exported groundnut oil. That example showed how difficult it was to deal with a single vegetable oil. In his opinion every effort should be made to raise the efficiency of coconut production in India. He felt that there was tremendous room for improving the efficiency both of production and marketing.

The Chairman said that it would facilitate matters if the Board first disposed of the question of the publication of the Report. The Board authorised the publication of the Report.

Mr. Devadhar said that Mr. Burt had very appropriately alluded to the need for improving the coconut industry. He urged also the necessity for immediate relief to the coconut growers all over India and in that connection he moved the following resolution for adoption by the Board :—

- “ In view of the facts (1) that the lowering of the effective tariff on copra and other coconut products has resulted in the last two years in a very large increase in the imports of such products,
- (2) that this has resulted in very low prices causing immense losses to the coconut grower and leading to deterioration of cultivation and lowering of the standard of living of a large population whose main occupation has been the cultivation and production of coconut,
- (3) that the Indian demand for coconut and its products can be easily met by Indian production itself, and
- (4) that the surplus needs of oil millers for raw materials for the manufacture of oil for industrial and commercial purposes can be met by other oil seeds already cultivated in the country in plenty,

this Council recommends to the Government of India that a specific duty of Rs. 100 a ton of copra with corresponding duties on nuts, oil and other coconut products may be immediately levied.”

2. This Council further recommends that in order to ensure that proper measures for research, cultural improvement, propaganda, and marketing in regard to coconuts and its products are taken, a Coconut Committee of the Imperial Council of Agricultural Research be formed on the lines of the Rice and Wheat Committees and further that if and when a Statutory Oil Seeds Committee comes into being, this committee may be replaced by special Coconut Sub-Committee of the Oil Seeds Committee.”

In support of the resolution Mr. Devadhar said that the condition of the coconut industry in India to-day was most unsatisfactory and that was due to several causes a few of which had been enumerated in the first part of the resolution. In explaining to the Board how he was interested in the matter, Mr. Devadhar said that during the last two years or so he had been going over the whole of the West Coast for the purpose of investigating the conditions of the co-operative movement in the States of Travancore and Cochin. He had come in contact with a very large number of cultivators and agriculturists who entirely depended on the production of coconuts and they had told him that they looked up to the Imperial Council of Agricultural Research for relief and the necessary assistance to them. In his opinion the Council was justified in giving a sympathetic consideration to the question and grant the necessary relief. The coconut industry was not confined to the West Coast as coconuts were largely grown in several other parts of India. There were 14 lakhs of acres under coconut cultivation throughout India, out of which between 10 and 12

lakhs were confined more or less to the East Coast, including about 6½ lakhs in the Travancore State. Mysore and some eastern districts of Madras were also interested in coconuts as also a few districts of Bombay, Bengal and Orissa. Hyderabad had not a large area under coconut at present, but he understood that there was a tendency on the part of the agriculturists to utilise as large an area as possible for the cultivation of coconuts. Confining his remarks to the West Coast alone, Mr. Devadhar thought that about 1 crore of people depended on the coconut industry and the number would be larger if taken for India as a whole. There were two causes which led to the depression in the industry. It was well-known that the catastrophic fall in prices was the first cause and the second was the competition which Ceylon had been enabled to carry on with the coconut industry along the West Coast. Here Mr. Devadhar referred to the various concessions the Ceylon Government had granted to their coconut industry in the matter of freights and tariffs. He quoted page 77 of Dr. Patel's Report in support of his contention and said the fact remained that the coconut industry on the West Coast had practically collapsed and under present conditions it was not possible for that industry to lift its head. The Coconut growers' Association, Cochin, were fully alive to the pitiable condition of the industry and they had now sent in a memorial to the Government of India to grant protection to the Indian coconut growers so as to enable them to meet Ceylon competition successfully. To afford the necessary protection to this industry they had suggested that the duty on copra might be raised to a specific duty of Rs. 100 per ton with a corresponding duty on nuts, oils and other coconut products, that being the immediate need of the country along the west coast and also in other parts of India. The coconut producing area in India was 1,400,000 acres and of this Cochin, Travancore and Malabar provided 1,000,000 acres. These three areas constituted the main centre of coconut cultivation as far as India was concerned. It therefore seemed that if prompt measures were taken by the Government of India to protect the industry no harm would be done to the consumer, to the tax-payers of the country or to the cultivators and growers of coconut. Another point was the improvement of the efficiency of production and marketing. In this matter, he had told the cultivators that it was not necessary to depend entirely on the Government of India or the Council but they must stand on their own legs by bringing some kind of organisation into existence which would take care of the various factors which were necessary, namely research, better organisation of agriculturists, cultural improvement, propaganda and marketing. Mr. Devadhar however hoped that as the Council had appointed an expert in marketing it would be possible for the west coast to get better results in that direction. For these reasons Mr. Devadhar suggested that it was necessary for the Board to recommend that a Coconut Committee on the lines of the Rice Committee and Wheat Committee should be brought into existence for the purpose of watching over the interests of the industry till such time as a statutory committee for the well-being of all oilseeds in the country was established. The Coconut Committee should then be made a sub-committee of an all-India Oilseeds Committee. He appealed to the Board to adopt the resolution as the coconut industry was the life-blood of the West Coast.

Mr. Ramamurty, in seconding the resolution moved by Mr. Devadhar said that Dr. Patel's report had not yet reached the Madras Government.

In making his remarks therefore he was only expressing the views held by the Madras Government and the Department of Agriculture before seeing this report. He first wanted to be associated with Mr. Burt in expressing appreciation of the industry and ability with which Dr. Patel had collected facts and figures and he was sure that the report would form a valuable basis for coming to the right conclusions. The enquiry had been the result of two conflicting demands—one from the growers of coconut for increasing the tariff on coconut imported mainly from Ceylon and the other from oil millers, mainly on the West Coast, for reducing further the tariff on coconut products so that they might have more raw material. Mr. Ramamurty felt that by lowering the duty on copra Bombay and Karachi would get their copra direct from Ceylon where the freight rates were even lower than the rate from the West Coast to Bombay and Karachi. If the duty on coconut oil was raised there would be an incentive to Calcutta and Rangoon to increase their oil industry but it would not help the West Coast where at present 130,000 tons of copra were produced. Bombay was only using something like 45,000 tons. The oil millers who were mainly responsible for raising this demand for further lowering the duty on copra and other coconut products were not going to gain by the methods proposed. On the other hand they would make the position of the coconut growers in the West Coast even worse than it was now. Mr. Ramamurty referred to the figures given on page 77 of the report and observed that due to the successive lowering of the effective import duty on a ton of copra by means of lowered tariff valuations, imports from Ceylon of coconuts had enormously increased. This had produced a fall in prices. He pointed out that in 1931-32 the imports of copra into India amounted to 24,512 tons while in 1933-34 it was 69,470 tons. This increase cannot be accounted for otherwise as the increase in consumption could only be gradual. Dr. Patel attributed this increase to the large consumption of the product in soap making and in the preparation of vegetable ghee and in commercial undertakings. The fact was that Ceylon had lost its market for this product in other countries due to the competition of soya bean oil and was dumping its coconuts on India. He felt that India could supply her own needs.

Mr. Ramamurty then explained as to how the figure of Rs. 100 was arrived at. In 1929 when the import duty of copra was Rs. 69 per ton, the agriculturists in the West Coast only realized the cost of cultivation; it was therefore suggested that, in order to provide a profit, the specific duty should be increased to Rs. 100. He however quoted the suggestion of the Cochin planters that the duty should be increased to Rs. 120 per ton. He commended the resolution of Mr. Devadhar to the favourable consideration of the Board.

Mr. Achuta Menon, Diwan Peishkar of the Cochin State, associated himself with the views expressed by Messrs. Devadhar and Ramamurty on the subject and said that unless some generous and immediate protection was afforded to the growers of coconut they would be absolutely ruined. The Cochin Government could not take any action in the matter because of their trade relations with the Government of India. He therefore appealed to the Board to accept the resolution moved by Mr. Devadhar.

Mr. Parameswaran Pillai, representing the Travancore State, said that the chief occupation of the majority of the people of the South West of India was the cultivation of the coconut and conversion of the produce

to copra and coconut oil. Till very recently this part of India, besides exporting large quantities of coconut products to foreign markets, had been supplying the needs of the whole of India. The increase in the imports from Ceylon during the past two or three years had led to an impression in some quarters that Malabar was not able to produce the quantity of these commodities as was necessary to meet the Indian demand. This, he thought, was the result of a lack of understanding of the real situation. Until about 1929 the quantity imported into India was practically negligible. In 1930 when there was a reduction in the tariff valuation of copra from Rs. 23 to Rs. 17 there was an import of 68 tons of copra into India. In 1931, 1932, 1933 and 1934 there were successive reductions in the tariff value so that at present the tariff valuation per cwt. of copra stood at Rs. 9. The excessive imports during these years did not indicate underproduction in India. If it was a fact that there was an increase in demand in India then there should be a corresponding increase in the prices but that was not the case; on the contrary, prices were very low on account of Ceylon dumping its copra into India. With the preferential tariff in America in favour of Philippines copra, and with the keen competition which Ceylon had to meet with Dutch East Indies, Ceylon was unable to sell her produce in the world markets and she was therefore sending her produce to India just to ruin the home industry and to capture our market. This was clearly borne out by the fact that the coconut plantations in Ceylon had ceased to pay any dividends for the last several years. The fact that Ceylon cultivators were pressing their Government for several concessions to save them from the present condition of the coconut industry was also a proof that the industry was not in a flourishing condition in Ceylon. Continuing Mr. Parameshwaran Pillai said that in Ceylon there was no land tax on coconut plantations, the export duty had been suspended by the Ceylon Government and the Government had secured special concessions for exporting produce to Bombay and other places. With these advantages Ceylon could well afford temporarily to sell at a loss so as to capture our markets. Referring to Dr. Patel's report, he said that it contained useful information but he regretted that his inferences were in most cases very misleading. Dr. Patel had made much of the export duty in the Travancore State and had said that this was putting difficulties in the way of coconut growers. The export duty was only a method of assessing land revenue and as such it was neither excessive nor preferential. In the Travancore State the land revenue demand was only about four annas per tree but in Cochin and Malabar and other coconut producing tracts in India, it was a little over seven annas, so that there was no point in saying that the revenue duty in the State was crushing the coconut industry there. Mr. Parameshwaran Pillai supported the resolution moved by Mr. Devadhar and appealed to the Board to adopt it.

In answer to Mr. McKerral's point that the Ceylon Government might probably retaliate, Mr. Ramamurty said that Ceylon had quite recently put a duty on rice, on eggs, on ghee, etc., coming from India to save their industries without so much as even consulting India and he saw no reason why they should be frightened by the counter steps that that Government might take in the present case. Here was a case of a large population who entirely depended on coconuts for their living being deprived of it, and India should not hesitate to protect them.

Rao Bahadur Tadulingam Mudaliar fully endorsed the views expressed by the previous speakers and said that coconut cultivation was gradually expanding even in the eastern districts of the Madras Presidency. He pointed out that two or three years ago coconut was selling in the Madras markets at the rate of Rs. 6 to Rs. 10 per hundred whereas the present market rate of coconut in Madras was Rs. 2 to 4 per hundred.

Mr. McKerrall questioned whether the fall in the price of coconut products was entirely due to dumping on the part of Ceylon and pointed out that the period for which some speakers had given statistics covered the period of a general fall in world prices. During the same period the price of Burma rice had fallen from Rs. 180 to Rs. 50.

Mr. Ramamurthy replied that the grower of coconuts was hard hit in both ways whereas in the case of rice the Advisory Board had only the previous day passed a resolution recommending that a duty of three farthings per pound should be imposed on all imports of foreign paddy into the United Kingdom.

Dr. Hyder said that the resolution should be considered in two parts, *viz.*, (1) the first part that dealt with tariffs and (2) the part that dealt with the constitution of a Committee. As to the first part, he was not prepared to accept it. There was not sufficient evidence to show that the fall in prices had resulted from the lowering of the effective tariff on copra and other coconut products as brought out by the first part of the resolution. In his opinion, the fall in the prices was but a feature of the present economic depression. In this connection, Dr. Hyder referred to paragraph 15 on page 146 of Dr. Patel's report and said that there had hardly been time for the members of the Board to go through the report carefully so as to be able to express a considered opinion on the matter. He said that the first part of the resolution was not in accordance with the conclusions arrived at by Dr. Patel and therefore suggested that the Board should not express an opinion on it. He had however no objection to the second part of the resolution with regard to the appointment of a coconut committee.

Mr. Ritchie was of the opinion that the resolution adopted by the Crop Planning Sub-Committee of the Advisory Board covered the present case and that the Board should recommend nothing beyond that :—
The resolution read—

“ That in order to promote the more efficient production and marketing of Indian agricultural produce, this sub-committee recommends that the Government of India should consider the advisability of imposing protective duties on the imports of animal and agricultural produce which compete with home-grown produce.”

Mr. Livingstone proposed that the second part of the resolution dealing with the appointment of a coconut committee should be put first. In supporting this part of the resolution, he suggested that they should specify the duties of the proposed committee in greater detail than was proposed in the resolution. It was not sufficient to say that the Committee should look to research, cultural improvement, propaganda, and marketing in regard to coconuts and its products. The resolution should also state that the Committee should take proper measures for the more

extensive and more efficient marketing of coconut and coconut products. With regard to the first part of the resolution dealing with tariffs, Mr. Livingstone proposed that it should be put second and suggested that it should read "that in order that the foregoing measures might not be rendered ineffective a specific duty in place of the present *ad valorem* duty should be put on coconuts and coconut products". In regard to the duty, he thought that it was too much to ask the Board to agree to a definite figure of Rs. 100 a ton without further enquiry. He referred to page 77 of Dr. Patel's report and pointed out that in 1929 the import duty on copra was Rs. 69 a ton. It would not therefore be too much to ask the Government that the position which existed in 1929 should be restored and that the specific duty to be imposed should not be less than the actual duty in 1929. He therefore suggested to the mover that he might amend this part of the resolution accordingly.

Mr. Burt supported the proposal made by Dr. Hyder that the Board should not express any opinion whatsoever on the question of tariffs raised in the first part of the resolution. The Board had not had time to consider all the information supplied to them by Dr. Patel and they would not therefore be justified in making so specific a recommendation on this point. Besides, as had been pointed out by Dr. Hyder, the first part of the resolution was not in accordance with the conclusion reached by Dr. Patel and if they were going to throw his conclusions overboard they must discuss the whole of the information contained in the report in much greater detail. As he had already pointed out, the question of specific duties was very complex and was one for the Commerce Department of the Government of India to consider—with or without a reference to the Tariff Board. There was also a danger in hastily recommending the specific duty of Rs. 100 a ton. Supposing this figure were too high, and that the Indian copra supply proved inadequate what would be the result? The oil-millers would not be able to get the supplies required and this would result in the import of more coconut oil, and if the duty on coconut oil in turn were prohibitive that might lead to the use of such imported substitutes as hardened whale oil. In this way one might do actual harm to the industry. For these reasons Mr. Burt thought that the Board should not go further than endorsing the resolution of the Crop Planning Sub-Committee referred to by Mr. Ritchie. He therefore moved that for the first part of the resolution the second part dealing with the appointment of a coconut committee be substituted and as a second part a resolution be added to the effect that the Board endorses the finding of the Crop Planning Sub-Committee and requests the Government of India to take action on those lines in regard to coconut and coconut products. Mr. Ritchie seconded the amendment.

Mr. Ramamurty accepted the suggestion of Mr. Livingstone that, instead of suggesting a figure of 100 rupees, the Board should recommend to Government that a duty not less than Rs. 70 which was in force in 1929 might be imposed. He quite understood Mr. Burt's point that the question of tariffs concerned the Commerce Department of the Government of India but he did not think that it was beyond the competence of the Board to suggest to Government a figure as a basis to go upon. It was only recently that Mr. Burt had himself supported Mr. McKerral's resolution suggesting a specific duty of three farthings on the import of foreign paddy into the United Kingdom.

Dr. Burns was of the opinion that the Board should not recommend any specific duty. If it did, the whole market would be affected tomorrow as the news would be soon out in the papers. He supported the proposal made by Mr. Burt.

The Chairman proposed that, in view of the necessity for more time to study the question in all its bearings, a small sub-committee be appointed to discuss the details of the problem and make a considered recommendation. It was further suggested that the Board should empower the sub-committee to submit their memorandum to the Government of India, in order to avoid delay, subject to further action by the Board at its next meeting, and that the formation of a Standing Coconut Committee should also be referred to the Sub-Committee. The Board agreed.

4. The meeting then adjourned till 10-30 A.M. on Saturday, the 8th September 1934.

BAZLUL KARIM,
for Secretary.

SIMLA :

The 7th September 1934.

Proceedings of the Tenth Meeting of the Advisory Board of the Imperial Council of Agricultural Research held at Simla, on Saturday, the 8th September 1934.

The following were present :—

1. Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E.,
Chairman.
2. Dr. B. K. Badami.
3. Dr. W. Burns.
4. Mr. B. C. Burt.
5. Mr. M. Carbery.
6. Mr. J. N. Chakravarty.
7. Mr. R. T. Davis.
8. Mr. G. K. Devadhar.
9. Mr. T. J. Egan.
10. Mr. E. S. Farbrother.
11. Khan Bahadur Maulvi Fatehuddin.
12. Dr. J. C. Ghosh.
13. Dr. L. K. Hyder.
14. Dr. V. N. Likhite.
15. Mr. A. M. Livingstone.
16. Mr. A. McKerral.
17. Brigadier H. S. Mosley.
18. Mr. A. M. Mustafa.
19. Rao Bahadur B. R. Naik.
20. Mr. Nizamuddin Hyder.

21. Lt.-Col. E. Noel.
22. Colonel A. Olver.
23. Mr. T. F. Quirke.
24. Mr. S. V. Ramamurty.
25. Mr. P. B. Richards.
26. Mr. J. H. Ritchie.
27. Mr. C. V. Sane.
28. Mr. P. T. Saunders.
29. Mr. D. R. Sethi.
30. Mr. S. I. A. Shah.
31. Dr. F. J. F. Shaw.
32. Rao Bahadur C. Tadulingam.
33. Mr. W. Taylor.
34. Mr. C. G. Trevor.

Rai Sahib Malik Charan Das, *Secretary*.

The following attended as visitors :—

1. Dr. S. P. Agharkar.
2. Mr. D. V. Bal.
3. Mr. E. J. Bruen.
4. Mr. A. P. Cliff.
5. Mr. R. H. Hill.
6. Mr. C. K. Inamdar.
7. Mr. S. N. A. Jafri.
8. Mr. H. C. Javaraya.
9. Mr. P. G. Krishna.
10. Dr. K. C. Mehta.
11. Professor J. H. Mitter.
12. Mr. I. N. Mahendra.
13. Mr. A. Mohiuddin.
14. Mr. John A. Munawar.
15. Mr. Nurul Islam.
16. Dr. B. C. Pal.
17. Professor P. K. Parija.
18. Mr. K. P. Pillai.
19. Mr. K. G. Raju.
20. Mr. T. S. Sabnis.
21. Mr. M. Vaidyanathan.
22. Rao Bahadur B. Viswanath.

2. The meeting commenced at 10-30 A.M. and adjourned at 12-40 P.M. having disposed of all the items on the agenda.

The Report of the Fruit Research Sub-Committee (Appendix XLI) was first taken into consideration.

3. *Application from the Andhra University for a grant of Rs. 18,200 spread over a period of five years for a study of fruits and vegetables with a view to their utilisation in manufacture.* (Subject No. 37 of the agenda, Appendix XLII).—The Chairman explained that, some work of the nature proposed in this scheme was in progress at Lyallpur and Poona and that the Fruit Research Sub-Committee had therefore recommended that it be referred back to the Andhra University for reconsideration in the light of the remarks made by the Committee. After that a revised scheme might be submitted if desired. The Board adopted the recommendation of the Committee.

4. *Application from the Government of North-West Frontier Province for a grant of Rs. 27,350 spread over a period of five years for research on the improvement of fruit culture in the North-West Frontier Province and the problem of marketing.* (Subject No. 38 of the agenda, Appendix XLIII).—The Fruit Research Sub-Committee had examined this subject in detail and recommended a grant of approximately Rs. 20,000 for the five year period for the provision of a Horticulturist. The Sub-Committee considered that many of the other items of the scheme represented expenditure which should be undertaken by the Local Government. The Board adopted the recommendation of the Committee.

5. *Application from H. E. H. the Nizam's Government, Hyderabad, for a grant of Rs. 58,610 spread over a period of five years for a fruit research scheme.* (Subject No. 39 of the agenda, Appendix XLIV).—The Board adopted the recommendations of the Fruit Research Sub-Committee and approved the scheme as modified by the Sub-Committee.

6. *Application from the Government of Mysore for a grant of Rs. 88,880 spread over a period of five years for a scheme for fruit cultivation in the Mysore State.* (Subject No. 40 of the agenda, Appendix XLV).—Mr. Javaraya said that the Fruit Research Sub-Committee had limited the scheme to two items, viz., apples and miscellaneous fruit (including pine-apples) for the reason that experiments on other fruits were already in progress in the Punjab and Hyderabad, and that a repetition of them was not necessary. He thought that further experiments were desirable in the interests of fruit research and the Board should at least make provision for experiments on fruits which were not indigenous to India. Coming to the financial aspects of the scheme, Mr. Javaraya said that the Fruit Research Committee had made a suggestion that the Farm Manager should be replaced by an Assistant Horticulturist on about Rs. 200 a month. He did not agree to the suggestion in the Committee because he thought that the technical portion of the scheme would be looked after efficiently by the experienced man provided by him. Since then, he had thought of the local audit rules and under these the bills, etc., passed by an officer on such a low scale would not be accepted by the Audit authorities. He now requested the Board to allow him to accept the suggestion of the Committee and raise the salary of the Farm Manager, who would be in charge of the Research Station, to Rs. 250 per mensem. Mr. Javaraya added that he had not included in the revised estimate of working expenses given in Committee, the charges on account of labour, manure, plants, seeds, etc., and he requested the Board to increase the provision made by the Committee by Rs. 16,000 to cover these items.

Mr. Sethi said that the Fruit Committee had carefully examined the scheme and disapproved all the details. He saw no reason therefore for re-opening the whole question again. The Chairman then put the following points for the consideration of the Board :—

- (1) Should the decision of the Fruit Research Sub-Committee to limit the scheme to two fruits be reversed ?
- (2) Should a Farm Manager be provided on a salary of Rs. 250 per mensem ?
- (3) Should an additional sum of Rs. 16,000 be provided under working expense on account of labour, manure, plants, seeds, etc. ?

Questions (1) and (2) were answered in the negative. With regard to (3), the Board decided that Mr. Javaraya, should submit a detailed statement of the additional working expenses required, to the Secretariat of the Council and that the Vice-Chairman should include such provision as he considered necessary in the revised scheme for submission to the Governing Body.

7. *Proposal to appoint three Assistants on Rs. 120—10—150 each in the place of the Physiological Botanist under the scheme of fruit research in Bihar and Orissa. (Subject No. 41 of the agenda, Appendix XLVI).—*

*Report on the experimental consignments of mangoes from Bombay to Great Britain during 1933. (Subject No. 42 of the agenda, Appendix XLVII).—*The Board adopted the recommendations of the Fruit Research Sub-Committee on these subjects.

8. *Note by Sir Harry Lindsay, Indian Trade Commissioner, London, on the subject of experimental consignments of fruit from India to the United Kingdom. (Subject No. 43 of the agenda, Appendix XLVIII).—*As desired by the Fruit Research Sub-Committee, Mr. Burt invited the attention of the Board to the facilities for the examination of experimental consignments of fruit which the High Commissioner for India had been able to arrange through the kind assistance of the Department of Scientific and Industrial Research of His Majesty's Government and proposed that the Board should convey its appreciation of these facilities to the High Commissioner. The Board carried the proposal unanimously.

9. *Application from the Government of Madras for a grant of Rs. 74,000 spread over five years for a scheme of research work on bananas. (Subject No. 44 of the agenda, Appendix XLIX).—*As modified by the Sub-Committee, the scheme was approved.

*Programme of work on the Bombay Cold Storage Research Scheme for 1934, 1935 and 1936. (Subject No. 45 of the agenda, Appendix L).—*The Board adopted the recommendations of the Fruit Research Sub-Committee.

10. *Application from the Government of Bengal for an extension of the scheme of research on the mechanical analysis of lateritic soils and on the nutrition of the rice plant at the Dacca University. (Subject No. 46 of the agenda, Appendix LI).—*

Progress Report for 1933-34 on the scheme of research into the properties of colloid soil constituents by Professor J. N. Mukherjee of the

*Calcutta University. (Subject No. 47 of the agenda, Appendix LIII).—*Mr. Burt introduced the report of the Standing Soil Science Committee (Appendix LI) and said that the Committee was extremely gratified at the success of the work and the Board had before it a very clear report embodying a number of definite results. The Committee had made several suggestions to Dr. Ghosh on points of detail and he had agreed to pay attention to these in the course of the current year's work. Passing on to the application for an extension of the scheme, the Committee had recommended that the whole scheme be extended for a period of three years from June 1935 subject to certain minor modifications. Dr. Ghosh had accepted the modification suggested by the Committee. Mr. Burt then moved that the report of the Standing Soil Committee be adopted and the extension of the scheme approved.

The proposal was carried.

11. *Note by Mr. Churchill, Deputy Director of Agriculture, Northern Circle, Central Provinces, on sann hemp as a fibre crop in the Central Provinces. (Subject No. 49 of the agenda, Appendix LV).—*

Application from the Government of Madras for a grant of Rs. 1,500 spread over three years for a scheme of experiments on the improvement of sann hemp fibre at the Agricultural Research Station, Samalkota.

Application from the Government of Bombay for a grant of Rs. 1,500 spread over three years for research work on sann hemp in the Bombay Presidency.

*Application from the Government of the Central Provinces for a grant of Rs. 20,060 spread over five years for a scheme of research work on sann hemp in the Central Provinces. (Subjects Nos. 50, 51, 52 of the agenda, Appendix LVI).—*The Board adopted the report (Appendix LIV) of the Sann Hemp Committee which had considered the schemes.

12. *Report on the investigations on cereal rusts by Dr. K. C. Mehta for the year 1933-34. (Subject No. 56 of the agenda, Appendix LVII).—*

*Application from the Government of the United Provinces for a grant of Rs. 1,24,000 for the continuance of the investigations on cereal rusts by Dr. K. C. Mehta, Professor of Botany, Agra College, for a further period of three years from March 1935. (Subject No. 57 of the agenda, Appendix LIX).—*The Board adopted the report of the Cereal Rusts Sub-Committee (Appendix LVII) and approved of the extension of this Scheme with the modifications introduced by the Sub-Committee.

13. *Progress Reports on Veterinary Research Scheme sanctioned by the Imperial Council of Agricultural Research :—*

- (i) *Annual Report on the work of the Veterinary Investigation Officer, Madras, for 1933-34.*
- (ii) *Annual Report on the work of the Veterinary Investigation Officer, Bihar and Orissa, for 1932-33 and 1933-34.*
- (iii) *Annual Report on the work of the Veterinary Investigation Officer, Hyderabad, for 1932-33 and 1933-34.*
- (iv) *Annual Report on the work of the Veterinary Investigation Officer, Punjab, for 1932-33 and 1933-34.*

- (v) Annual Report on the work of the Veterinary Investigation Officer, Bombay Presidency, for 1933-34.
- (vi) Annual Report on the work of the Veterinary Investigation Officer, Central Provinces, for 1932-33 and 1933-34.

[Subject No. 36 (i) to (vi) of the agenda, Appendix LX].

Progress Reports on Veterinary Research Schemes sanctioned by the Imperial Council of Agricultural Research :—

- (i) Annual Report on the work of the Veterinary Investigation Officer, Bengal, for 1932-33 and 1933-34.
- (ii) Annual Report on the work of the Veterinary Investigation Officer, Assam, for 1933-34.
- (iii) Annual Report on the work of the Veterinary Investigation Officer, United Provinces, for 1933-34.

(Subject No. 66 of the agenda, Appendix LXI).

Colonel Olver, in introducing the report of the Progress Report Committee (Animal Husbandry Section), said that the idea of the scheme was to obtain information as to diseases of stock throughout India which would otherwise not be obtainable. The Committee were unanimous that the scheme was producing a great deal of valuable information as expected. The main difficulty at present was that the Imperial Institute of Veterinary Research, Muktesar, could not deal satisfactorily with the mass of material that was thus becoming available, for want of staff. To overcome this difficulty, Colonel Olver suggested that the Government of India be requested to bring the Institute at Muktesar up to its full sanctioned strength as quickly as possible. He further emphasised the necessity of holding an annual meeting of the Disease Investigation Officers at Muktesar as proposed in the original schemes at some convenient time, so that they could meet and discuss their problems with the research workers at the Institute and at the same time post themselves with up-to-date knowledge of the work going on there. Another suggestion which Colonel Olver put forward was that, if possible, an annual conference of Research Workers should be arranged and held at each veterinary college in turn. That would enable research workers, disease investigation officers and others to meet and acquaint themselves with the work in progress. Continuing, Colonel Olver said that in order to investigate disease problems satisfactorily it was essential to have a Central Nutrition Institute at which the nutritional aspect of disease could also be dealt with. To deal with the matter satisfactorily it was necessary to have a well-equipped Central Animal Nutrition Institute which would co-ordinate animal nutrition investigation work in the provinces and co-operate closely with the Muktesar Institute in the investigation of disease. One great advantage of working on these lines would be that a number of young men would thus be trained up in the proper prosecution of research and would be able to take on research appointments as and when required. In regard to the effect of nutrition on disease, it was essential to have team work between nutrition workers and veterinary workers. He then moved that the report of the Committee be adopted. Mr. Quirke supported Colonel Olver's proposals and said that the Committee was agreed that results of great value were being obtained from the Disease Investigation Officers' scheme. The Board adopted the report of the Committee and also accepted the

suggestion of Colonel Olver that the necessity of bringing the Imperial Institute of Veterinary Research, Muktesar, up to its strength be impressed upon the Government of India.

14. *Application from the Government of the Central Provinces for a grant of Rs. 10,088 spread over four years for research work on the "gangai" pest of rice—Entomological work under the scheme of rice research already sanctioned by the Council for the Central Provinces. (Subject No. 32 of the agenda, Appendix XXXI).*—Dr. Shaw said that he had been asked by the Board to prepare a small scheme to enable this investigation to be carried out by the staff of the Imperial Entomologist. His estimate (Appendix XXXI-A) was that an expenditure of about Rs. 3,000 a year on travelling allowance would enable the Second Entomologist, one Fieldman and a Laboratory Attendant from the Imperial Institute of Agricultural Research to tour in the Central Provinces for a period totalling about six months for the purpose of this investigation. He had provided for two years' work on the scheme and if the investigation was completed before the whole grant was expended there would naturally be a corresponding saving. With these remarks Dr. Shaw commended the scheme to the Board. Mr. Ritchie accepted the scheme and the Board recommended it for sanction.

15. *Annual Report of the Madras Potato research scheme for the year 1933-34. (Subject No. 54 of the agenda, Appendix LXIII).*

Potato Breeding Scheme for Northern India. (Subject No. 55 of the agenda, Appendix LXIV).—The Board adopted the report of the Potato Committee (Appendix LXII) on these schemes.

16. *Application from the Government of the Central Provinces for a grant of Rs. 46,200 spread over a period of four years for a scheme of research work on pan cultivation. (Subject No. 58 of the agenda, Appendix LXV).*—Mr. Ritchie, in introducing the scheme, said that for the study of the causes of *pan* disease and for evolving suitable remedial measures continuity of experiments for a period of years was essential and that this continuity could not be ensured unless the department had *pan* gardens of its own in different districts. It was proposed to do the work in eight places, and it was hoped that there would be a net profit of Rs. 6,400 per year. The scheme therefore was a profitable one and should be sanctioned. Dr. Burns had every sympathy with the scheme but he could not see what Dr. Dastur was going to do in the eight gardens proposed by him. The scheme itself was not clear inasmuch as it was difficult to find out exactly what each item would cost. He was therefore not prepared to support the scheme in its present form. Dr. Shaw agreed with Dr. Burns that they had no details as to the precise investigations to be carried out on *pan* disease. The Chairman summed up the discussion and proposed that the scheme be returned to the Central Provinces Government for revision so as to give more precise details in regard to both the scientific and financial aspects. The Board agreed.

17. *Provincial schemes for the improvement of agricultural marketing. (Subject No. 64 of the agenda, Appendix LXVI).*—Mr. Livingstone introduced the report of the Marketing Sub-Committee and moved for its adoption. Mr. Sane said that the constituent States of the Council as well as

other States should also be given an opportunity of associating themselves and participating in the marketing investigations. He felt that no picture of marketing conditions in India would be complete without them. He therefore moved the following resolution :—

“ That this Board recommends to the Government of India that the Imperial Council of Agricultural Research be permitted to make suitable financial grants to the constituent States for the purpose of marketing investigations already decided upon in British Indian provinces.”

Mr. Javaraya seconded the resolution. Mr. Nizamuddeen Hyder, in supporting the resolution, said that if it is left to the choice of the Indian States to co-operate with the Imperial Council of Agricultural Research in carrying out the enquiry at their own expense some of them may not carry out the work for fear of expenditure. If this happens the whole enquiry will remain incomplete. In the interest of the scheme itself it is necessary that the States should be helped financially. Messrs. Permeshwaram Pillai and Devadhar and Dr. Hyder also spoke in support of the resolution. Mr. Richards said that his Government had no objection to bringing the Indian States on the same footing as British India in the scheme. Mr. Ramanurty said that economic questions in Madras were so closely connected with the States of Hyderabad, Mysore, Cochin and Travancore that their inclusion in the marketing scheme would be of great value to the Madras Presidency. In answer to Professor Parija, Mr. Livingstone said that, in the case of numerous small States which could not afford to appoint their own marketing staff, it would be appreciated if they would appoint someone who could co-operate with the marketing officers of the neighbouring provinces and allow the latter to make an investigation of the marketing conditions in that particular State. Mr. Burt, in supporting the resolution, said that the constituent States of the Council were already fully entitled to be treated in the same manner as the British provinces so far as assistance from the central marketing staff was concerned. He would like to make it clear that there was no attempt whatever to take away this right from the constituent States. The present position had arisen on the Government of India having gone even further than the Board recommended a year ago, and as a very special case had agreed to grants to the Provinces, for a limited period in order that marketing work might be speeded up. The resolution was then put to vote and carried unanimously.

The various marketing schemes were then taken up. In answer to Colonel Noel, Mr. Livingstone said that for the provincial marketing officers it was essential to have a good knowledge of Indian conditions and of vernaculars. Dr. Hyder assumed that in the absence of anything to the contrary, the Public Service Commission would take it that a good knowledge of Indian conditions and vernacular was required. Colonel Noel enquired whether the salary of provincial marketing officers would be subject to the five per cent. cut. The Chairman replied that in the case of the old rates of pay the cut applied whereas in the case of new rates of pay it did not. Mr. McKerral said that in his province marketing work was already in progress and they had sent a number of experimental shipments of beans, mangobeans, etc. He wanted a guarantee that if the Local Government paid the salary of the senior marketing officer who would be in charge of the marketing work, the work already going on in the

province would not be stopped, in order to do the survey work. Mr. Livingstone said that there was no such intention. *The report of the Marketing Sub-Committee was adopted.*

18. *Proposal to appoint Provincial Dairy Committees. (Subject No. 65 of the agenda, Appendix LXVII).*—Colonel Olver introduced the subject. Dr. Burns opposed the proposals on the grounds that most of them were not marketing work. Colonel Olver explained that it was not the intention when the recommendation of the Provincial Economic Conference was accepted that these committees should carry out marketing work but that they should assist Marketing Officer by making suggestions and taking action to improve the local dairy industry. There was a good deal of discussion as to the necessity of having Provincial Dairy Committees to deal with purely dairying problems that arose out of the marketing surveys. The sense of the Board was that there was no necessity to establish such a committee in each province at this stage. Mr. Burt suggested that the question of appointing provincial dairy committees might be deferred until the next meeting of the Board as the Provincial Directors concerned might take time to consider how best committees of the nature proposed could best be fitted in with existing Provincial Committees and Boards dealing with livestock improvement or marketing. The Board accepted this suggestion.

19. *Application from the Government of Madras for a grant of Rs. 92,487 spread over a period of three years for a scheme of research for improving the fishing industry and developing the supply of fish manure. (Subject No. 10 of the agenda, Appendix III).*—The Chairman explained that a decision on this subject had been postponed for want of information as to what the Madras Government had done to exploit the new sources located by the trawler. He then called on Mr. Ramamurty to acquaint the Board with the information he had received. Mr. Ramamurty read out the following telegram from the Madras Government :—

“Your telegram regarding fish manure scheme. Since disposal trawler nothing done by Government to exploit new fishing banks discovered though Yorkshire Coble was obtained as most suitable for use in Indian waters. Unfortunately trawler broke down immediately after arrival of Coble. As no expert available not even demonstration with Coble possible but possibilities Coble as fishing boat were demonstrated near Sethubavasatram in September 1933. Trawler's discoveries have attracted private attention. Already two fishermen have applied for full particulars of trawlers survey as well as chart. One set up refrigerating plant and factory on East Coast and started freezing curing fish and experiments in manufacture fish meal and manures on Tanur methods. One on West Coast endeavouring to get big refrigerating plant in view success attained by him with small one worked with guidance and help of Department.” The Chairman then informed the members of the Board that he had received a telegram from one Mr. Madhavan saying that the fishermen of the West Coast protested against purchasing a trawler and research expenditure. He said that the Board could not interfere in the matter which was for the Local Government. The protests should have been made to the Government of Madras. Mr. Burt suggested that the recommendation of the Fertilisers Committee be accepted and the condition recommended by the Fertilisers' Committee be attached to any grant that

might be made to this scheme. The Board accepted the suggestion and approved the recommendation of the Fertilisers' Committee.

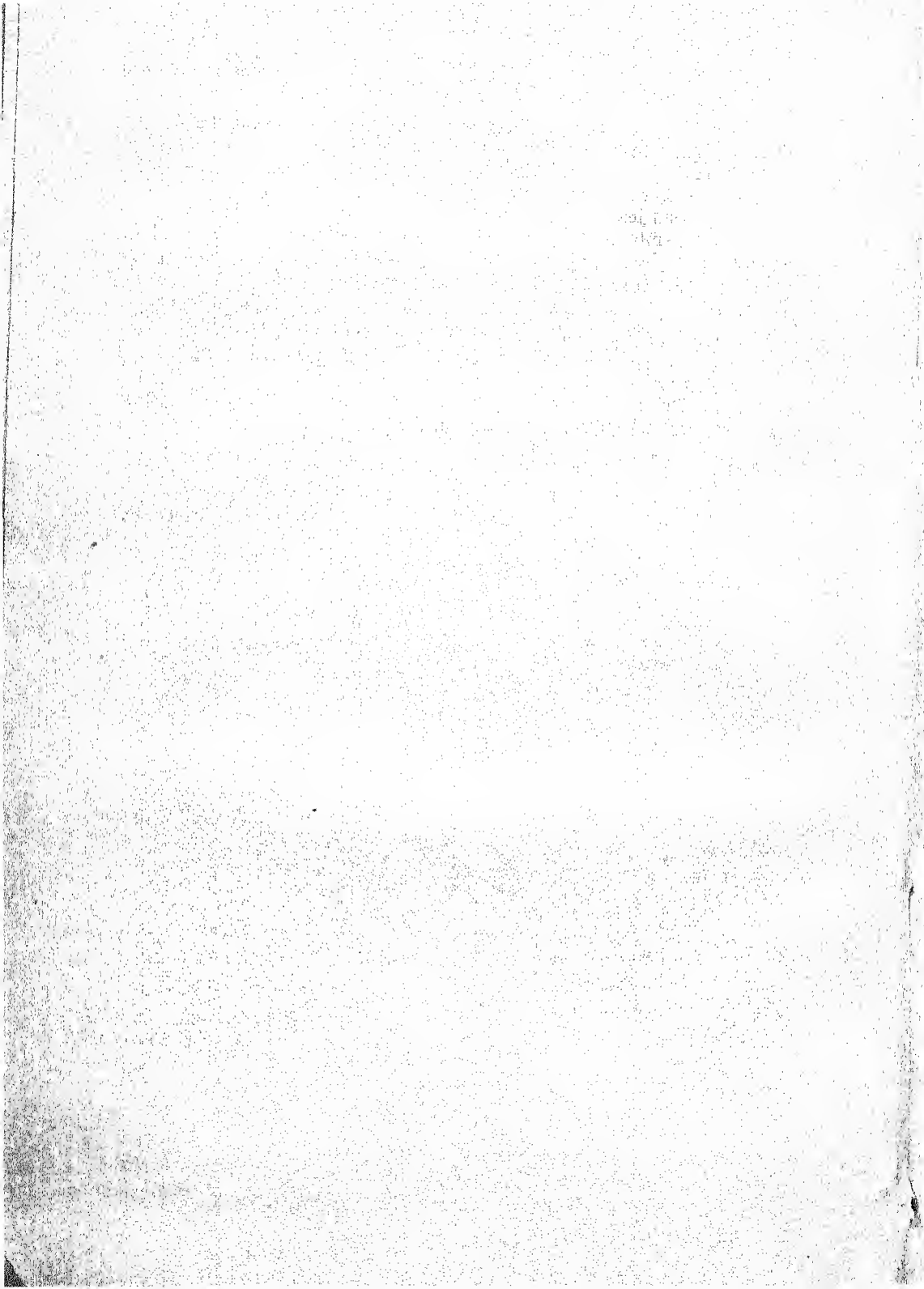
20. *Report of the Tractor Ploughing work carried out by the Burma Shell Oil Storage and Distributing Company of India, Limited, Bombay, during the 1933-34 season. (Subject No. 59 of the agenda, Appendix LXVIII).*—The Chairman explained that the Tractor Committee appointed to consider this subject was to meet in the afternoon. It was not necessary to detain members of the Advisory Board for that purpose and he suggested that the report of the Committee be circulated and also placed before the next meeting of the Board. This was agreed to.

21. All the items on the agenda having been disposed of, the Chairman thanked the members for their courtesy, readiness and cheerful co-operation which had made it possible to dispose of a very heavy agenda within the allotted time. On the motion of Mr. Devadhar the Board passed a vote of thanks to the Chairman expressing appreciation of the able and tactful manner in which he had conducted the proceedings.

The meeting then came to a close.

CHARAN DAS,
Secretary.

SIMLA,
The 8th September 1934.



APPENDIX I.

NOTE, DATED THE 27TH AUGUST 1934, ON SUBJECT No. 2, APPOINTMENT OF COMMITTEES.

1. *Rice Committee*.—There are certain rice research and progress reports which are included in the Agenda for the consideration of the Advisory Board. The Vice-Chairman to the Council considers that it will be an advantage to have them all examined in the first instance by the Committee of the Board which examined similar reports at the last meeting of the Board held in February 1934 and which consisted of the following gentlemen :—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, Burma, Bihar and Orissa and Central Provinces.

The Director, Imperial Institute of Agricultural Research, Pusa.

Rao Bahadur B. Viswanath.

Professor P. K. Parija, Ravenshaw College, Cuttack.

Dr. J. C. Ghosh.

Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

In addition the Vice-Chairman to the Council has invited Professor S. P. Agharkar and R. H. Dastur to attend the meeting of the Committee as visitors.

The Committee will meet at 2-45 P.M. on Monday the 3rd September 1934 and consider the undermentioned items of the Agenda :—

23. Annual Reports on the working of the Rice Research Schemes in Madras and the United Provinces (1933-34) and the Central Provinces (September 1932 to March 1934).

24. Application from the Government of Bengal for a grant of Rs. 43,152 spread over three years for a Scheme of research work on the Physiology of the rice plant by Dr. S. P. Agharkar of the Calcutta University.

28. Scheme from the Government of Madras for an investigation into the quality of rice.

29. Progress report for the year 1933-34 on the scheme of research work on rice physiology by Dr. R. H. Dastur, Royal Institute of Science, Bombay.

30. Application from the Government of Bengal for a grant of Rs. 21,600 spread over five years for a scheme of research on the Bio-chemical and physico-chemical properties of rice at the Bio-Chemical laboratory of the Dacca University.

31. Scheme from the Government of Bihar and Orissa for research on the quality of rice.

32. Application from the Government of the Central Provinces for a grant of Rs. 10,088 spread over four years for research work on the "gangai" pest of rice-Entomological work under the scheme of rice research already sanctioned by the Council for the Central Provinces.

2. *Tobacco Committee*.—At its meeting held in August 1933 the Advisory Board recommended that a Committee of people who have specialised in work on tobacco should be appointed to consider the steps which have to be taken to supplement the programme of work already approved by the Council. In consultation with the Directors of Agriculture and others interested in the tobacco trade the Vice-Chairman to the Council has appointed the under-mentioned committee for the purpose :—

1. Diwan Bahadur Sir T. Vijayaraghavacharya, Chairman, *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. The Marketing Expert, Imperial Council of Agricultural Research.
4. Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa.
5. A Representative of the Department of Agriculture, Bengal, to be nominated by the Government of Bengal.
6. The Director of Agriculture, Burma, Rangoon.
7. Mr. B. S. Patel, Deputy Director of Agriculture, Gujerat (Bombay).
8. Mr. G. K. Raju, Deputy Director of Agriculture, Guntur (Madras).
9. Mr. A. P. Cliff, Deputy Director of Agriculture, North Bihar Range, Muzaffarpur.
10. The Director of Agriculture, Baroda.
11. Pandit Brij Kishore, Aga, Tobacco Merchant, Saharanpur.
12. Seth Chhotalal Kuberbhai Inamdar, Tobacco Merchant, Jodia Bazaar, Karachi.
13. H. Abbott, Esq., C/o the Imperial Tobacco Co. of India, Ltd., Virginia House, 37, Chowringhee, Calcutta.
14. Mr. Ramlal D. Shroff, C/o Messrs. Chhaganlal Kasturchand, Lalsing Building, Shaikh Memon Street, Bombay 2.
15. Leslie Frederick Cocks, Esq., B.A., Indian Leaf Tobacco Development Co., Ltd., Chirala, M. and S. M. Railway.
16. K. S. Sankaran Pillai, Esq., L. Ag., Tobacco Specialist and Exporter, Maidan View, Guntur.

17. H. G. P. Vostermans, Esq. C/o Messrs. Spencer and Co., Ltd., Madras.
Secretary—Secretary, Imperial Council of Agricultural Research,
ex-officio.

The Committee will meet at 2-45 P.M. on Tuesday, the 4th September 1934 and consider the undermentioned items :—

1. Consideration of the Agenda for the Committee.
2. Research programme on Tobacco, having due regard to the scheme of work already sanctioned and to the need for further work on other types of Tobacco and in the provinces.
3. Formulation of a co-ordinated programme of agricultural research for the improvement of the Tobacco Crop in India.
4. In view of the need for encouraging alternative cash crops, to consider what steps should be taken to encourage the greater production of cigarette tobacco in India in order to take advantage both of the large internal market and of the valuable Imperial preference in the United Kingdom which is guaranteed till 1942.
5. Possibility of obtaining detailed statistics of tobacco production in India.
6. Proposal for the appointment of a Central Tobacco Committee.
7. Application from the Andhra University for a grant of Rs. 1,000 for a Scheme to find out the best method of extracting Nicotine commercially from tobacco waste and to design an apparatus for the same (Subject No. 35 of the Agenda for the meeting of the Advisory Board, September 1934).

3. *Fruit Committee*.—In accordance with the practice followed in the past the Committee of the Board which consists of the members named below will examine the fruit schemes on the Agenda :—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, Punjab, Bihar and Orissa, Central Provinces, Assam, Hyderabad, Mysore and Baroda.

The Agricultural Officers, North-West Frontier Province and Baluchistan.

The Chief Publicity Officer, Indian State Railways.

The Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-45 P.M. on Wednesday, the 5th September 1934 and consider the undermentioned items of the Agenda :—

37. Application from the Andhra University for a grant of Rs. 18,200 spread over a period of five years for a study of fruits and vegetables with a view to their utilisation in manufacture.

38. Application from the Government of North-West Frontier Province for a grant of Rs. 27,350 spread over a period of five years for research on the improvement of fruit culture in the North-West Frontier Province and the problem of marketing.

39. Application from H. E. H. the Nizam's Government, Hyderabad, for a grant of Rs. 58,610 spread over a period of 5 years for a fruit research Scheme.

40. Application from the Government of Mysore for a grant of Rs. 88,880 spread over a period of five years for a Scheme for fruit cultivation in the Mysore State.

41. Proposal to appoint three Assistants on Rs. 120—10—150 each in the place of the Physiological Botanist under the scheme of fruit research in Bihar and Orissa.

42. Report on the experimental consignments of mangoes from Bombay to Great Britain during 1933.

43. Note by Sir Harry Lindsay, Indian Trade Commissioner, London, on the subject of experimental consignments of fruit from India to the United Kingdom.

44. Application from the Government of Madras for a grant of Rs. 74,000 spread over five years for a scheme of research work on bananas.

45. Programme of work on the Bombay Cold Storage Research Scheme for 1934, 1935 and 1936.

4. *Soil Science Committee*.—In accordance with the usual practice in such cases the two soil science items which are included in the Agenda for the consideration of the Advisory Board will be examined in the first instance by the Soil Science Committee of the Council which consists of the following :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
 2. The Agricultural Expert, Imperial Council of Agricultural Research.
 3. Mr. A. P. Cliff, Deputy Director of Agriculture, North Bihar Range, Muzaffarpur, Bihar and Orissa.
 4. Dr. J. K. Basu, Soil Physicist, Sugarcane Research Station, Bombay, Deccan-Padegaon.
 5. Rao Bahadur B. Viswanath, Agricultural Chemist to Government Madras.
 6. Dr. P. G. Krishna, Agricultural Chemist to the Government of Hyderabad.
 7. Dr. E. Mackenzie Taylor, Director, Irrigation Research, Punjab.
 8. The Agricultural Chemist to the Government of Central Provinces.
 9. Dr. J. C. Ghosh, Head of the Department of Chemistry, University of Dacca.
- Secretary, Imperial Council of Agricultural Research—Secretary, *ex-officio*.

The Committee will meet at 2-45 P.M. on Thursday the 6th September 1934, and consider the undermentioned items of the Agenda :—

46. Application from the Government of Bengal for an extension of the scheme of research on the mechanical analysis of lateritic soils and on the nutrition of the rice plant at the Dacca University.

47. Progress Report for 1933-34 on the Scheme of research into the properties of colloid soil constituents by Professor J. N. Mukherjee of the Calcutta University.

5. *Sunn-Hemp Committee*.—At its meeting held in February 1934 the Advisory Board decided that the sunn-hemp schemes which had been received from the Governments of Madras, Bombay and the Central Provinces should be referred to an *ad hoc* Committee to be appointed by the Chairman of the Board. The Vice-Chairman to the Council has accordingly appointed the undermentioned committee for the purpose :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. The Director of Agriculture, Madras.
4. The Director of Agriculture, Bombay.
5. The Director of Agriculture, Bengal.
6. The Director of Agriculture, United Provinces.
7. The Director of Agriculture, Bihar and Orissa.
8. The Director of Agriculture, Central Provinces.
9. Mr. T. S. Sabnis (subject to the approval of the United Provinces Government).

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-45 P.M. on Thursday the 6th September 1934 and consider the following items of the Agenda :—

49. Note by Mr. Churchill, Deputy Director of Agriculture, Northern Circle, Central Provinces, on sunn-hemp as a fibre crop in the Central Provinces.

50. Application from the Government of Madras for a grant of Rs. 1,500 spread over three years for a scheme of experiments on the improvement of sunn-hemp fibre at the Agricultural Research Station, Samalkota.

51. Application from the Government of Bombay for a grant of Rs. 1,500 spread over three years for research work on sunn-hemp in the Bombay Presidency.

52. Application from the Government of the Central Provinces for a grant of Rs. 20,060 spread over five years for a scheme of research work on sunn-hemp in the Central Provinces.

6. *Rust Research Committee*.—The Vice-Chairman to the Council considers that Dr. K. C. Mehta's scheme for the continuance of the investigations on cereal rusts and the report on his investigations for the year 1933-34 should be considered in the first instance by a Committee and he has accordingly appointed the undermentioned committee for the purpose :—

1. Sir T. Vijayaraghavacharya, K.B.E., Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa.
4. Dr. W. Burns, Director of Agriculture, Bombay.
5. Mr. P. B. Richards, Officiating Director of Agriculture, United Provinces.
6. Khan Bahadur Fateh-ud-Din, Officiating Director of Agriculture, Punjab.
7. Mr. D. R. Sethi, Director of Agriculture, Bihar and Orissa.
8. Mr. J. H. Ritchie, Director of Agriculture, Central Provinces.
9. Mr. W. Jenkins, Chief Agricultural Officer, Sind.
10. Professor J. H. Mitter, Allahabad University.
11. Professor T. Ekambaram, Madras University.
12. Dr. K. C. Mehta, Professor of Botany, Agra College
13. Dr. B. C. Pal, 2nd Imperial Economic Botanist.

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, Secretary, *ex officio*.

The Committee will meet at 2-45 P.M. on Friday the 7th September 1934 and consider the following items of the Agenda :—

56. Report on the investigations on cereal rusts by Dr. K. C. Mehta for the year 1933-34.

57. Application from the Government of the United Provinces for a grant of Rs. 1,24,000 for the continuance of the investigations on cereal rusts by Dr. K. C. Mehta, Professor of Botany, Agra College, for a further period of three years from March 1935.

7. *Potato Committee*.—The Vice-Chairman to the Council considers that it will be an advantage to have the potato schemes, etc., on the Agenda considered first by a sub-committee consisting of :—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, Punjab, Bihar and Orissa, Central Provinces and Assam.

The Director, Imperial Institute of Agricultural Research, Pusa.

Professor P. K. Parija, Ravenshaw College, Cuttack.

Dr. B. C. Pal, 2nd Imperial Economic Botanist, Imperial Institute of Agricultural Research, Pusa.

The Secretary, Imperial Council of Agricultural Research, Secretary,
ex-officio.

The Committee will meet at 4-15 P.M. on Friday, the 7th September 1934 and consider the following items of the Agenda :—

54. Annual Report of the Madras Potato research Scheme for the year 1933-34.

55. Potato Breeding Scheme for Northern India.

58. Application from the Government of the Central Provinces for a grant of Rs. 46,200 spread over a period of four years, for a scheme of research work on pan cultivation.

8. *Tractor Committee*.—The report of the Tractor Ploughing work carried out by the Burniah Shell Company during the 1933-34 season has been received and the Vice-Chairman to the Council considers that it will be an advantage to have the report considered in detail by the same technical committee as examined the company's report for the season 1932-33. The personnel of the aforesaid committee is as follows :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

2. The Agricultural Expert, Imperial Council of Agricultural Research.

3. The Hon'ble Mr. E. Miller of the Burmah Shell Company.

4. Mr. Wynne Sayer, Imperial Agriculturist, Pusa.

5. The Director of Agriculture, Madras.

6. The Director of Agriculture, Bombay.

7. The Director of Agriculture, United Provinces.

8. The Director of Agriculture, Punjab.

9. The Director of Agriculture, Bihar and Orissa.

10. The Director of Agriculture, Baroda.

The Secretary, Imperial Council of Agricultural Research, Secretary,
ex-officio.

The Committee will meet at 2-45 P.M. on Saturday, the 8th September 1934 and consider the following item :—

59. Report of the Tractor Ploughing work carried out by the Burma Shell Oil Storage and Distributing Company of India, Ltd., Bombay, during the 1933-34 season.

The report of the Committee will be submitted to the Advisory Board at the next meeting of the Board.

9. *Standing Cattle Breeding Committee*.—The Vice-Chairman to the Council considers that it will be an advantage to have the cattle breeding items included in the Agenda for the consideration of the Advisory Board examined in the first instance by the Standing Cattle Breeding Committee of the Council and which consists of the following :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
2. The Animal Husbandry Expert, Imperial Council of Agricultural Research.
3. Mr. E. J. Bruen.
4. Sardar Dost Mohammad Khan.
5. Captain C. E. MacGuckin.
6. Mr. T. F. Quirke.

The Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-45 P.M. on Monday, the 3rd September 1934 and consider the following items of the Agenda :—

22. Application from Mr. J. J. DeValois, Principal, American Arcot Mission, Agriculture Institute, Katpadi, Madras, for a grant of Rs. 78,876 for goat breeding in the Madras Presidency spread over a period of 10 years.
25. Application from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 15,864 spread over three years for a scheme to investigate the preparation of eggs for marketing and other methods of disposal.
26. Application from the Government of Madras for a grant of Rs. 37,580 spread over a period of ten years for sheep breeding research in Madras.
27. Application from the Government of Hyderabad for a grant of Rs. 77,960 spread over a period of 10 years for a scheme of research in Sheep breeding.
36. (vii) Annual Report of Dr. A. E. Slater's goat breeding Scheme for the year 1933-34.

In addition the Committee will consider the following :—

- (a) Representations which have been made regarding the slaughter of lambs for their pelts.
- (b) Suggestions for the institution of herd book and flock registers in India.

10. *Standing Annual Nutrition Committee*.—One Animal Nutrition Scheme is on the Agenda of the Advisory Board. In accordance with the usual practice in such cases the Vice-Chairman to the Council considers that the scheme might

be examined in the first instance by the Standing Animal Nutrition Committee of the Council which consists of the following :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
2. The Animal Husbandry Expert, Imperial Council of Agricultural Research.
3. Dr. P. E. Lander, Agricultural Chemist, Punjab.
4. Mr. F. J. Warth, Physiological Chemist, Punjab.
5. Dr. K. C. Sen, Bio-Chemist, Imperial Institute of Veterinary Research, Muktesar.
6. Rao Bahadur B. Viswanath, Imperial Agricultural Chemist, Pusa.

The Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

In addition the Vice-Chairman of the Council has invited Mr. J. R. Haddow, Veterinary Research Officer (Serology), Muktesar and the Physiological Chemist, Dacca, to attend the meeting of the Committee as visitors. The Committee will meet at 2-45 P.M. on Tuesday, the 4th September 1934 and consider the undermentioned item of the Agenda :—

33. Application from the Government of Bengal for a Supplementary grant of Rs. 15,571 in connection with the appointment of a Physiological Chemist to study Animal Nutrition problems at Dacca.

The Committee in addition will consider the following :—

- (a) A note by Dr. P. E. Lander on methods and procedure in connection with the mineral investigation in fodders, etc.
- (b) The question of the establishment of an enlarged animal nutrition Institute.
- (c) Reports on animal nutrition research for 1933-34.

11. *The Progress Report Committee*.—There are a number of progress reports on the Animal Husbandry side and the Vice-Chairman to the Council considers that it will be an advantage to have them examined, as usual, by a technical Committee in the first instance. He has accordingly appointed subject to the Advisory Board's approval the undermentioned Committee for the purpose :—

1. The Vice-Chairman, Imperial Council of Agricultural Research Chairman, *ex-officio*.
2. The Animal Husbandry Expert, Imperial Council of Agricultural Research.
3. Mr. T. F. Quirke, Director of Veterinary Services, Punjab.
4. Mr. P. T. Saunders, Director of Veterinary Services, Madras Presidency.

5. Mr. W. Taylor, Offg. Director, Imperial Institute of Veterinary Research, Muktesar.
6. Mr. R. T. Davis, Offg. Director of Veterinary Services, Bihar and Orissa.
7. Mr. T. J. Egan, Director, Veterinary Services, United Provinces.
8. Mr. J. R. Haddow, Veterinary Research Officer, Muktesar.
9. Mr. E. S. Farbrother, Director of Veterinary Services, Bombay Presidency.
10. Mr. B. K. Badami, Director of Veterinary Services, Hyderabad.

The Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet at 2-45 P.M. on Wednesday, the 5th September 1934 and consider the following items of the Agenda :—

36. Progress Reports on Veterinary Research Scheme sanctioned by the Imperial Council of Agricultural Research :—

- (i) Annual Report on the work of the Veterinary Investigation Officer, Madras, for 1933-34.
- (ii) Annual Report on the work of the Veterinary Investigation Officer, Bihar and Orissa, for 1932-33 and 1933-34.
- (iii) Annual Report on the work of the Veterinary Investigation Officer, Hyderabad, for 1932-33 and 1933-34.
- (iv) Annual Report on the work of the Veterinary Investigation Officer, Punjab, for 1933-34.
- (v) Annual Report on the work of the Veterinary Investigation Officer, Bombay Presidency, for 1933-34.
- (vi) Annual Report on the work of the Veterinary Investigation Officer, Central Provinces, for 1932-33 and 1933-34.

66. Progress Reports on Veterinary Research Scheme sanctioned by the Imperial Council of Agricultural Research :—

- (i) Annual Report on the work of the Veterinary Investigation Officer, Bengal, for 1932-33 and 1933-34.
- (ii) Annual Report on the work of the Veterinary Investigation Officer, Assam, for 1933-34.
- (iii) Annual Report on the work of the Veterinary Investigation Officer, United Provinces, for 1933-34.

12. *Committee for Awarding Prizes.*—The undermentioned technical committee will examine the entries received in connection with the award of prizes for veterinary scientific instruments and appliances for the year 1934 :—

- Mr. R. T. Davis, Offg. Director of Veterinary Services, Bihar and Orissa.
- Mr. E. S. Farbrother, Director of Veterinary Services, Bombay Presidency.
- Mr. P. T. Saunders, Director of Veterinary Services, Madras Presidency.

The Committee will meet at 4-30 p.m. on Wednesday, the 5th September 1934.

A plan is attached showing the date, time and place of the meetings of the various committees and also the subjects which will be considered by them.

Plan showing the time and place of the meetings of the various Committees which will meet from the 3rd to the 8th September 1934 in connection with the Advisory Board Meeting.

	Agriculture.	Animal Husbandry.
Monday, 3rd September.	Rice Committee. (2-45 p.m. Davico's Ball-room). Items 23, 24, 28, 29, 30, 31 and 32 of the Advisory Board.	Standing Cattle Breeding Committee. (2-45 p.m. Davico's Ball-room). Items 22, 25, 26, 27 and 36 (vi) of the Agenda.
Tuesday, 4th September.	Tobacco Committee. (2-45 p.m. Davico's Ball-room). Special Agenda, also item 35 of the Advisory Board.	Standing Animal Nutrition Committee. (2-45 p.m. Davico's Ball-room). Item 33 of the Agenda.
Wednesday, 5th September.	Fruit Committee. (2-45 p.m. Davico's Ball-room). Items 37, 38, 39, 40, 41, 42, 43, 44 and 45 of the Advisory Board.	(i) The Progress Report Committee. (2-45 p.m. Davico's Ball-room). Items 36(i)—(vi) and 66 of the Advisory Board. (ii) Committee for judging for the award of medals. (4-30 p.m. Davico's Ball-room).
Thursday, 6th September.	(i) Soil Science Committee. (2-45 p.m. Davico's Ball-room). Items 46 and 47 of the Advisory Board. (ii) Sunn-Hemp Committee. (2-45 p.m. Davico's Ball-room). Items 49, 50, 51 and 52 of the Advisory Board.	
Friday, 7th September.	(i) Rust Research Committee. (2-45 p.m. Davico's Ball-room). Items 56 and 57 of the Advisory Board. (ii) Potato Committee. (4-15 p.m. Davico's Ball-room). Items 54, 55 and 58 of the Advisory Board.	
Saturday, 8th September.	Tractor Committee. (2-45 p.m. Davico's Ball-room). Item 59 of the Advisory Board.	

APPENDIX II.

NOTE, DATED THE 6TH AUGUST 1934, ON SUBJECT No. 9, EXISTING CONDITION OF THE FISHING INDUSTRY AND ITS POSSIBILITIES OF DEVELOPMENT IN SO FAR AS THE SUPPLIES OF FISH MANURE ARE CONCERNED.

Attention is invited to the attached note, dated 2nd January 1934 (Enclosure I) and the annexures mentioned therein (except the copy of Mr. Sorley's report on the marine fisheries of the Bombay Presidency, referred to in Annexure IV) which were placed before the 2nd meeting of the Fertilisers Committee of the Imperial Council of Agricultural Research, held at New Delhi in February 1934. It will be seen from the attached extract (Enclosure II) from the proceedings that the Committee recorded its opinion that on the information before it fish meal was valuable both as manure and as food for livestock, and recommended its development by the provinces concerned.

The recommendation of the Committee is now for the consideration of the Advisory Board.

ENCLOSURE I.

NOTE, DATED THE 2ND JANUARY 1934, ON SUBJECT No. 6, EXISTING CONDITION OF THE FISHING INDUSTRY AND ITS POSSIBILITIES OF DEVELOPMENT IN SO FAR AS SUPPLIES OF FISH MANURE ARE CONCERNED.

Attention is invited to the attached extract (Annexure I) from the Proceedings of the first meeting of the Fertilizers Committee held at Simla on the 17th June 1930. An enquiry was made from the Governments of Madras, Bombay, Bengal and Burma as to the existing condition of the fishing industry and its possibilities of development in so far as supplies of fish manure were concerned. The Local Governments' replies will be found in Annexures II to V. Only one copy of Mr. Southwell's Report, mentioned in the Bengal Government's letter (Annexure III) was received and the same will be available to the members at the meeting. Relevant extract will be found in the annexure to Annexure III. A copy of Mr. Sorley's "Report on the marine fisheries of the Bombay Presidency" referred to in the Bombay Government's letter (Annexure IV) is also attached.

The subject is now for the consideration of the Committee.

ANNEXURE I.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE FERTILIZERS COMMITTEE APPOINTED BY THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD AT SIMLA ON TUESDAY, THE 17TH JUNE 1930.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, Chairman.
2. Mr. R. G. ALLAN.
3. Mr. B. C. BURT.
4. Dr. W. H. HARRISON.

5. Dr. L. K. HYDER.
6. Dr. P. E. LANDER.
7. Mr. MILNE.
8. Mr. V. RAMADAS PANTULU.
9. Mr. D. L. SAHASRABUDDHE.
10. Dr. J. SEN.
11. Mr. D. R. SETHI.
12. Mr. S. B. SINGH.
13. Rao Sahib B. P. VAGHOLKAR.
14. Rao Bahadur B. VISWANATH.

Mr. M. S. A. HYDARI, Secretary.

2. The meeting lasted from 11 A.M. till 4-30 P.M. with an interval for lunch from 1-15 P.M. to 3 P.M.

5. (e) *Fish manure.*

Mr. Burt quoting figures said that the export of fish manure was steadily diminishing which was an encouraging fact pointing to its greater consumption within the country. Rao Bahadur Viswanath said that the reason for diminishing exports was possibly the fact that the fish were disappearing from the west coast where, so far as Madras was concerned, the fish industry was concentrated. Mr. Sahasrabuddhe said that fish were partially disappearing from the Bombay coast also. Mr. Burt said that there were plenty of fish in the Chilka Lake in Bihar and that fish manure was being largely used in tea gardens instead of bonemeal. Mr. Sethi said that fish refuse used as manure did not give good results on ordinary crops and therefore the Agricultural Department in Bihar and Orissa were investigating the possibility of composting this material in order to do away with the scales. Both in Madras and on the Chilka Lake in Bihar and Orissa the fisheries were well organised. Mr. Burt said that the Chilka Lake was ideal for a well organised fish industry as the railway line was right on the spot. Mr. Sethi observed that fish were also found in large numbers at the mouth of rivers in Bihar. Finally, at the Chairman's suggestion it was agreed that enquiries should be made between now and the next meeting from the Director of Fisheries, Madras, and the concerned authorities in Bombay, Bengal and Burma as to the existing condition of the fishing industry in those provinces and as to its possibilities of development in so far as supplies of fish manure were concerned.

ANNEXURE II.

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BURMA, LOCAL GOVERNMENT DEPARTMENT, No. 308-O.30, DATED THE 1ST NOVEMBER 1930.

In reply to your letter No. 2262/Agri., dated the 18th October 1930 (not printed), I am directed to say that fish manure in Burma is mainly

the product known as "prawn dust" produced at Mergui and other Tenassarim ports and exported to the Straits where it is used chiefly by Chinese market gardeners. The total export in 1926-27 were 2,628 tons foreign trade and 2 tons coasting. Thus the amount available is quite negligible so far as the demand for fertilisers for the paddy crop is concerned. Further, this material is far too expensive to be used in paddy cultivation. It was tried formerly at Hmawbi experimental farm and its use was found unprofitable. The Ministry does not think that there is any possibility of development in the production of ordinary fish manure as the *ngapi* industry absorbs all surplus fish and there are few or no waste product. The above information is perhaps sufficient in so far as supplies of fish manure in Burma is concerned.

ANNEXURE III.

LETTER FROM THE ASSISTANT SECRETARY TO THE GOVERNMENT OF BENGAL,
No. 5257, DATED THE 21ST NOVEMBER 1930.

With reference to your letter No. 2262-Agril., dated the 18th October 1930 (not printed), I am directed to forward copy of a Report on Fishery Investigations in Bengal, and Bihar and Orissa by Mr. T. Southwell, late a Deputy Director of Fisheries, Bengal, and Bihar and Orissa, and to say that as there is at present no Fisheries Department in Bengal it is not possible to supply any information beyond that contained in the report. (*Vide* Annexure below.)

ANNEXURE.

EXTRACT FROM THE REPORT ON FISHERY INVESTIGATIONS IN BENGAL AND BIHAR AND ORISSA, BY T. SOUTHWELL, DEPUTY DIRECTOR OF FISHERIES, BENGAL AND BIHAR AND ORISSA.

* * * * *

(f) *Fish manure*.—The daily catches of any trawlers working in the Bay would include quantities* of fish of various kinds for which there would be no market. Amongst such might be mentioned saw-fish (*Pristis* spp.), small skates (*Trygon* spp.), and Narcine, Aetobatis, Rhinodon, Stegostoma, Myliobatis, etc., etc. Amongst the Teleosts also, numbers of fish unsuitable for the market would also be obtained. These would include the smaller fry generally, extremely bony fish such as *Tricanthus brevirostris*, all species of "parrot fish" (*Tetrodon* spp.), etc., etc. The fish indicated above, together with many others, could all be utilised in the manufacture of fish manure for which there is a sure and certain demand in Bengal. Thurston (*loc. cit.*) states that the supply of fish manure manufactured from sardines varies between 2 to 215 tons a year, depending entirely on the paucity or otherwise of the Sardine. An industry in fish manure or fish-meal would be sure to be both successful and lucrative, and the principal difficulty would be in meeting the demand.

*Manure may be manufactured from fish unsuited for the market.

ANNEXURE IV.

LETTER FROM THE CHIEF SECRETARY TO THE GOVERNMENT OF BOMBAY,
REVENUE DEPARTMENT, No. 1023-D.28, DATED THE 17TH FEBRUARY
1931.

With reference to your letter No. 2262-Agri., dated the 18th October 1930 (not printed), I am directed by the Government of Bombay (Transferred Departments) to state that the last published report on the fishing industry in the Bombay Presidency is the 'Report on the improvement of fisheries in the Bombay Presidency' written in 1910 by Mr. W. H. Lucas, I.C.S., who was then Collector of Salt Revenue, Bombay. A copy of this report is enclosed for the information of the Council (returned to the Local Government). Mr. H. T. Sorley, I.C.S., the present Collector of Salt Revenue, Bombay, has now been entrusted with the work of bringing Mr. Lucas' report up to date and it is understood that this work may be completed by the end of the current year. A brief statement of facts relating to the industry is given below :—

The total area of the sea lying between the coast of the Bombay Presidency from Bhatkal at the southern limit to Cape Monze, a few miles west of Karachi and the 100 fathom line is approximately 60,000 square miles.

Fishing is conducted all along the coast. There are 33 Curing Yards on the coast line of which 18 are in the Ratnagiri District and 15 in the Kanara District. These yards are under the control of the Collector of Salt Revenue. Curing in the yards is still done by primitive methods. Attempts were made by the Department of Industries to improve these on the lines adopted on the Malabar and South Kanara Coast but since the abolition of Fishery Section of the Department in the year 1922, no further progress has been made in these curing yards.

In the years 1928-29 and 1929-30, the total quantity of fish brought for curing to these yards was 309,000 and 216,000 maunds, respectively. During these years 237,000 and 164,000 maunds of cured fish were removed from the yards.

Imports and exports of dried salted fish and unsalted fish from Bombay were valued at Rs. 21,19,000 and Rs. 2,47,000, respectively in 1928-29. The export of fish from Karachi in the same year was valued at Rs. 10,56,000.

The prime fish of the Bombay Presidency are : Pomfret, Ravas, Karel, Tambusa, Wam, Dori, Surmai, Bombay Duck and Goal.

2. As regards the point raised by the Council, *viz.*, the possibilities of development in so far as supplies of fish manure are concerned, the following note by the Collector of Salt Revenue, Bombay, furnishes information on the subject :—

'All edible fresh fish that are caught on the coast of this Presidency are taken immediately to the market for sale or to the fish curing yards for being cured as these fish fetch a good price. Only decomposed small fish or surplus fish are used as manure for vegetable and fruit gardens. If such fish cannot be sold fresh they are dried and used as manure but the quantity thus turned out is very small.'

The indigenous fish manure resources of this Presidency in the present condition of the fish industry are, therefore, inadequate to supply the full needs of agriculturists and planters. The local supply is largely supplemented by imports of fish manure from the Madras Presidency and Kathiawar ports. In the existing state of things manure is obtainable from the following sources :—

- (1) Small fish such as sardines and pedis which swim in shoals.
- (2) Fish-heads and fish offal.
- (3) Sea-weed.

' 2. As regards (1). In favourable seasons large shoals of sardines and pedis appear on the coast between November and February. They are of little commercial value as edible fish. They are cured with salt dried on the beach and are then utilised as fish manure. Such manure finds its way to the up-ghat districts and is also exported by sea to other places. Sardines, containing, as they do, a considerable proportion of natural oil, take some time before they decompose if they have been sun-dried and the results of using such fish as manure are said to be disappointing. If sardines are first boiled and their oil extracted, the solid remains after pressing and drying constitute a valuable fertiliser, and the crude oil so extracted can be used for smearing boats, batching jute and curing leather, etc. The oil and guano thus extracted amount to nearly 4 per cent. and 20 per cent., respectively, of the wet fish used. The oil if purified can be used medicinally. There are two such sardine oil presses in operation, one at Majali and the other at Honawar in the North Kanara District, but the catches of sardines are irregular and the yield of oil is scanty. There is moreover no regular system of marketing the product.

As regards (2). When large quantities of ghol and shingala (cat fish) are brought to the curing yards, the heads of these fish and the offal are removed and thrown away. This waste product, if collected and preserved, would serve as a valuable fertiliser. In the same way, mackerel, which are caught in large quantities in drag nets, surmai, karli, shark, etc., which are caught in fairly large quantities and are gutted before being cured would supply a good fish manure if the offal which is thrown away or buried on the beach is systematically collected and preserved. It would be possible to collect several tons of offal from the fish curing yards on the coast.

As regards (3). In the southern part of the Presidency sea-weed is washed ashore during the spring tides and stormy weather. It is collected in large quantities, sun-dried on the beach and used as manure for cocoanut trees. It might be worth-while investigating the commercial possibilities of this sea-weed as manure.'

In 1928-29 imports and exports of fish manure into and from Bombay were valued at Rs. 2,06,000 and Rs. 80,000, respectively, while the export of fish manure from Karaehi was valued at Rs. 2,77,000. In this Presidency the possibilities of the development of fish manure industry can only be realized with the general development of the fishing industry. The following are some of the essential conditions for the development of Fish Manure Industry :—

- (1) Fishing methods must be improved.
- (2) Introduction of fish canning on modern lines.

- (3) Establishment of reduction plants in places where large quantities of poor type of fish are available.
- (4) Quick transport of fish from the fishing grounds to the shore.
- (5) Arrangements for the collection of residue from the fish markets in large towns.
- (6) Arrangements for the collection of offal, etc., from the fish euring yards on the coast.

There is at present no Department of this Government charged with the work of development of fishing industry, but the question of developing fisheries will be considered on receipt of Mr. Sorley's report referred to in paragraph 1 above.

ANNEXURE V.

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, No. 1204-IV-30-8, DATED THE 12TH OCTOBER 1931.

I am directed to forward a note prepared by the Director of Fisheries, Madras, on the existing conditions of the fishing industry in this Presidency and the possibilities of its development with reference to the production of fish manure as desired in your letter No. 2262-Agri., dated the 18th October 1930 (not printed).

The existing condition of the fishing industry.

The fish manure industry of the Madras Presidency is mainly confined to the districts of Malabar and South Kanara. The refuse from shelled prawns resulting from the extensive sea and back-water fisheries of Northern Circars are used for manurial purposes, but, no regular trade exists in this commodity. The coasts of Malabar and South Kanara are visited by enormous shoals of fish, especially from July to February, the chief fish being sardine and mackerel. Whenever catches are in excess of the local demand as fresh or cured fish, they are converted into oil and manure, the next best use to which they could be put. Most of the guano and oil is obtained from the sardine. I append statistics of the quantities and value of the fish oil and manure industry of the two districts for the decade ending 1930. While in exceptionally abundant years (1923) the quantity of manure produced has reached the high figure of 32 thousand tons which represents at least 64 thousand tons of fresh fish, in a very poor year (1930) the quantity has dropped to 223 tons.

There has been an unusual dearth of sardines for the last six years on the West Coast and the manure industry is in consequence, in a declining state at present. Past experience has shown, however, that sardines are erratic in their appearance. While they are extraordinarily abundant in some years in inshore waters, in other years they may be practically absent. This uncertainty keeps the manure industry in an unsettled condition. The rapid improvement in the transport of fish effected by the opening of new lines of railways and the rapid growth of motor communications to the interior markets is also to a small extent diminishing the surplus quantity of fish that used to be available on the West Coast for manurial purposes. Unless the whole question is investigated and a constant supply of fish over and above the food requirements is ensured, the availability of fish-manure as a fertiliser will continue to be unsteady.

Possibilities for development of the fish-manure industry.

The possibilities of development of the industry fall under two heads (a) increase in the supply of fish or raw material, and (b) improvement in the method of manufacture of guano and bye-products.

(a) *Increase in the supply of fish or raw material.*—Canoes and crafts with drift and small nets alone are plied by the local fishermen up to 5 and rarely 7 fathoms from the coast. Full advantage is not taken of the enormous quantities of shoal fish available even in this area during favourable seasons on account of the primitive craft and tackle used. There are many varieties of fish which are of little or no food value and are, therefore, eminently suited for conversion into manure. In the course of the last quarter of a century, during which the Madras Fisheries Department has worked, the improvement of sea-fishing methods has rightly been recognised as its primary duty, although no immediate success crowned its efforts in this direction. Fishermen in India are an extremely poor, ignorant and conservative caste. They consequently have neither the initiative nor the capital to develop the industry. The more enlightened and wealthy castes are precluded by the caste system from entering the fishing profession which is not their parental occupation. Fishing craft and methods in India have, in consequence, remained extremely primitive in spite of the great strides made in other professions in recent times. The dug-out canoe and the catamaran (a raft) are the only fishing craft in the country. On account of the small-sized nets and appliances used and the total absence of mechanical power or labour-saving devices, the area fished by local fishermen is the strictly inshore belt of the sea up to an extreme limit of ten miles from the shore. In western countries and in Japan and Australia, on the other hand, powerful vessels equipped with steam or motor power and the latest labour-saving devices in fishing gear of every description exploit the seas over hundreds of miles from the home ports. It will, therefore, be self-evident that efforts to improve the indigenous craft and tackle and to extend the local fishermen's range of operations will be the most hopeful line of research, if catches are to be augmented and the fishing and manure industries are to be stabilised. The development of our sea-fishery by introducing improved boats and appliances, however, has presented great difficulty, largely due to the conservatism and poverty of the fisher-folk and the considerable expenditure involved in marine investigations.

Several types of vessels have been tried by the department without success. Motor boats of different designs ranging from 5 tons ('Pearl') up to 20 tons ('Sea Scout') and larger fishing craft from Ratnagiri drifters, a schooner with auxiliary motor ('Lady Nicholson') and a small steamer ('Margaritta') have been tried. All in their turn proved their unsuitability and the one unmistakable lesson of the past was the need for the services of an expert Master Fisherman for conducting experiments and for a vessel of approved pattern and sufficient size and sea-worthiness to stand monsoon-weather conditions in India. A trawler is the minimum size steamer that can withstand the monsoon in India and is suitably designed for fishery research of every description. For this reason, the Fishery Departments in all countries which engage in deep-sea research employ only trawlers for such investigations. A smaller vessel will not only run great risks in monsoonish weather but will not give the necessary

accommodation and facilities for a scientific staff and a Master Fisherman on board who has to be an European in the absence of deep-sea fishing anywhere in India. The choice of a trawler for investigation and the entertainment of an expert sea fisherman was, therefore, the inevitable logical consequence of the abortive efforts of the Fisheries Department in the past. Accordingly, the Government of Madras decided to purchase an Admiralty trawler and entertained Capt. Cribb, an experienced sea fisherman, who has a knowledge of Indian waters and was instrumental in introducing fish-trawling in Japan and China. The acquisition of this trawler ('Lady Goschen') enabled more intensive investigations to be undertaken out at sea.

The immediate work of the trawler has been defined as the survey and discovery of deep-sea fishing grounds and fisheries immediately beyond the depths fished by the local fishermen up to the 100 fathoms line, which is roughly from 15 to 50 miles from the coasts. The most casual enquiry is sufficient to convince one that the professional knowledge on which the sea-going fishermen depend for the successful prosecution of their trade, is a fairly certain knowledge of the nature of the fisheries of their coast at different seasons obtained by actual experience in the course of centuries. It is on the knowledge of the occurrence of the different classes of fish at different seasons and times according to wind, weather, sea and sea bottom that the fisherman trades. The local fisherman's fund of information on all these matters pertaining to his industry in inshore-waters is fairly complete and there remains little to be discovered or taught to him. But he now knows practically nothing about the contents and character of our seas out-side the 7 miles range. Unless similar knowledge regarding the deeper sea beyond is made available to the fisherman, he will obviously never be able by himself in his present state of ignorance and poverty to extend his field of operations or exploit deep sea fisheries. The whole aim, therefore, of the trawler is to obtain and make available such knowledge. After completing the survey of deep sea fishing she will prepare a chart on the model of Close's Fisherman's chart of the North Sea. So far as the department and the Government are concerned, this knowledge of the deep-sea fisheries is the only safe and sure foundation on which any intelligent and useful scheme of fishery development can be based. That a sudden jump from the catamaran or canoe to a steam trawler is impossible, and even if possible would be inadvisable, was recognised years ago—*vide* Madras Fisheries Bulletin, Vol. I, page 84. The reason, then, for the acquisition of the trawler as explained above is that the experience for the last quarter of a century has proved vessels of smaller size to be useless for deep-sea exploration and experiment.

The chart of the fishing banks of the off-shore belt which the trawler has set itself to prepare should give depths, correct to a fathom throughout, the times of the tide at various points, detailed information of the character of the bottom for purposes of fishing and anchorage, the limits of fishing banks with information regarding the occurrence of principal varieties of fish, the months in which they abound and full particulars of their abundance and the methods for their capture. This will necessitate the survey of successive sections of the coast in successive months of the year. As the coast line of this Presidency is about 1,700 miles in length,

the study of the whole coast, it has been computed, may require as many as 21 years of survey. In view of this prolonged period and the availability of only a single trawler, the Madras Government decided to give the scheme a trial in two selected sections of the East and West Coasts—Point Calimere to Madras, and Calicut to Pigeon Islands—so as complete the monthly observations for a full fishing season within 1932.

For various reasons continuous research with the trawler was not possible from the beginning. Her full equipment of different types of nets and tackle for an examination of fish at the bottom, in midwater, and at the surface of the sea, a laboratory on board to study the collections made and to make scientific observations, and an adequate research staff to work on board the trawler were not provided till 1929 and 1930. Only since then systematic work has been possible. Even so, a year's work on two selected sections of East and West Coasts respectively from Point Calimere to Madras and Calicut to Pigeon Islands, has enabled the vessel to make some remarkable discoveries of fish-resources. The presence of fish in deeper water on both the coasts when the local fishermen complain of a dearth of fish in inshore waters has been brought to light in several places.

The occurrence of the following extensive fisheries in certain seasons, of which the fishermen are totally ignorant, have been noted on the East and West Coasts :—

- (i) Extensive shark grounds off Point Calimere.
- (ii) A large squat-nosed lobster fishery from Point Calimere to Cuddalore and beyond.
- (iii) A large squat-nosed cuttle-fish fishery off Coondapur.
- (iv) Two new food-fish fisheries between Point Calimere and Madras.

(ii) and (iii) are not highly esteemed food fish and when exploited are likely to provide raw materials as fish-meal for food of live-stock and manure for agricultural purposes.

Even more startling discovery that has been made by the trawler seems to be the fact that the off-shore belt on the East Coast from Point Calimere to Madras is $5\frac{1}{2}$ times as rich as the corresponding section of the sea on the West Coast. The prevailing belief that the West Coast is far more productive of fish than the East Coast is apparently true only of the strictly inshore grounds fished by fishermen. This, if established by further research, is likely to have far-reaching effects in the development of the East Coast fisheries and the manure industry.

(b) *Improvement in the method of manufacture of guano and by-products.*—Fish fertiliser was made from sardines by the ancient and accepted procedure of spreading the sardines on the sands of the open beach to sun-dry them. While the amount of sardine oil produced was inconsiderable and of the lowest possible quality, the fertilizer had two grave drawbacks. Large quantities of valuable oil of no manurial value were lost and the manure became so highly impregnated with sand that analysis not infrequently showed the resultant mass to contain as much as 40 per cent. of this useless adulterant. The simple experiments con-

ducted by the department since 1908 at the Tanur station and unexampled and swift success. It was found that a simple and quite inexpensive plant could be devised to separate the oil and fertilizer effectively and profitably. The high quality of the oil and fertilizer ('fish-guano' as it is now known technically) reacted favourably upon prices, and has rendered this new industry so profitable that literally hundreds of small private factories have come into existence on the Malabar and South Kanara coasts. In this case, the demonstrations we were able to give were so conclusive financially that the small capitalists of the West Coast rushed to share in the big profits that were being made by those first in the field. In the year 1922-23, a highly favourable sardine year, as many as 647 factories existed and manufactured fish oil and manure worth Rs. 36 lakhs. A further advance has again been made during the past two years whereby it appears likely that a good proportion of the fish guano now used as fertilizer will eventually be utilised more profitably as food for live-stock, cattle, pigs, dogs, poultry, etc. Success has already been obtained in the Tanur Experimental Station in producing on a small scale high class *fish meals* from all the common fish found plentifully on the West Coast, particularly mackerel and sardine. Those who have tried these meals for cattle, pigs, dogs, and poultry speak highly of them when employed in proper proportions with other foods. At the Wembley Exhibition, where samples were exhibited, there were several enquiries for the supply of the meal in bulk (Hundreds of tons). It now remains to produce the meal on a commercial scale and to introduce them widely to the notice of the public. In Europe and America the high nutritive value of these meals is recognised and the fish-meal trade there is assuming large and important proportions. The conversion of 'scrap' (fish pressed for oil) into fish meal is more remunerative to the manufacturers than conversion into fish-guano. Though the present reference is confined to the fish fertilizer trade, fish meal is of great value to the agriculturist and for that reason I mention it here.

Beyond the first and comparatively simple process of boiling the fish and expressing the oil successfully copied by private enterprise, nothing has been done by private producers on the Malabar Coast in refining the oil up to market standards or in perfecting the manufacture of guano or fish meal. There is much that remains to be done by technological research in improving the methods of manufacture. For example, the process of boiling and expressing the oil by hand presses, which is now done at the Tanur Government Fisheries Station and in private factories, appears wasteful inasmuch as the proteins and other nitrogenous substances from the fish are lost in liquid form. Much also remains to be done in improving the mechanical devices for manufacture on a commercial scale, thereby cheapening production and standardizing the quality of the product. In fact, the different steps in the manufacture of guano require research by an expert Bio-Chemist. The degree of freshness of the fish required for high class manure, the correct temperature for boiling and the period for which boiling should be continued, the method of separation of oil without detriment to the quality of the manure, the degree of dryage of 'scrap', etc., all require investigation by an expert before the West Coast fish guano industry could claim to have attained even a reasonable degree of success. Besides, the perfection of the methods of manufacture of fish meal referred to above, which is a more

remunerative industry and one of considerable importance to the agriculturist, requires also the services of an expert Fisheries Bio-Chemist and Technologist.

Recommendations.

For the successful development of the fish manure and allied industries, it will be evident from the above that (1) the research and investigations connected with the inauguration of deep sea fishing already started by this department should be continued in order to provide a steady and cheap supply of fish, (2) a Fisheries bio-chemical laboratory should be established at Tanur Fisheries Station and the services of an expert Bio-Chemist should be entertained for a term of years for determining the best methods of manufacture.

Owing to the financial stringency, the Madras Government may find it difficult to continue the survey begun by the trawler beyond March next. Any financial aid that the Council of Agricultural Research is in a position to give will enable the Madras Government to decide on the continuance of these experiments to a successful conclusion. The average annual expenditure on the trawler is Rs. 70,000 a year.

In 1927 I proposed the establishment of a Fisheries bio-chemical laboratory at Tanur for research in the manufacturing methods of fish oil, guano, and fish meal. I recommend the entertainment of a competent and experienced Fisheries Bio-Chemist for at least three years for research on fish oil and guano. The most important questions he will investigate are (1) the best processes for the manufacture of fish oil, guano and fish meal, and (2) the machinery best suited for the manufacture of these commodities from Indian fish. These two items of research alone should provide ample work for the Technologist Laboratory for the period of three years.

The estimated expenditure on this proposal for the first year will be as follows :—

	Rs.
Non-recurring expenditure—	
Chemicals, apparatus and fittings	10,000
Recurring expenditure—	
Pay of the Bio-Chemist and Technologist at Rs. 1,200 a month	14,400
Pay of the Research Assistant on Rs. 70—5—120—10—250	840
Pay of Research Laboratory Assistant on Rs. 65—4—125	780
Pay of Research Clerk on Rs. 35—60	420
Pay of the Research Peon on Rs. 12—18	144
Contingencies for pay of watchman and miscellaneous charges, furniture, books, etc.	1,000
Apparatus, chemicals, etc.	1,000
Travelling allowance	1,000
Total	29,584

The pay of the Technologist has been fixed at Rs. 1,200 a month as I recommend the entertainment on a short term agreement of an expert

who has had wide experience of the work. From enquiries abroad, I find that it will be impossible to entertain a competent officer who has experience of the work for less pay. One of the Assistants to the United States Bureau of Fisheries, with considerable experience in the manufacture of oil and guano and who has also actually patented improved processes and machinery when interviewed by me in 1929, agreed to come to India on leave for a term of years, but considered this salary as the lowest for which he could arrange to come. A grant of Rs. 30,000 for the first year and Rs. 20,000 recurring expenditure for the subsequent two years is, therefore, required for the proposed technological laboratory and research.

Year.	Number of factories.	Amount of fish oil produced.	Value of fish oil.	Amount of fish guano produced.	Value of fish guano.	Amount of fish manure produced.	Value of fish manure.	Total value of fish oil, guano and manure.
		Tons.	Rs.	Tons.	Rs.	Tons.	Rs.	Rs.
1919-20	563	..	3,75,000	24,000	24,00,000	..	..	27,75,000
1920-21	646	..	..	1,500	15,00,000	..	..	1,15,000
1921-22	542	..	..	1,000	1,30,000	..	..	1,30,000
1922-23	647	12,000	12,00,000	32,000	24,00,000	..	..	36,00,000
1923-24	440	7,250	14,50,000	22,500	13,50,000	17,000	6,80,000	34,80,000
1924-25	515	2,000	4,16,000	4,000	4,25,000	1,000	1,00,000	9,41,000
1925-26	463	4,980	8,50,000	9,850	7,50,000	1,000	70,000	16,70,000
1926-27	504	460	1,15,000	2,100	2,52,000	2,100	2,10,000	5,77,000
1927-28	470	200	50,000	850	95,000	10,000	10,00,000	11,45,000
1928-29	282	70	21,000	1,100	1,10,000	15,000	7,50,000	8,81,000
1929-30	80	24	9,000	223	27,875	1,111	71,100	1,47,975

ENCLOSURE II.

EXTRACT FROM THE PROCEEDINGS OF THE 2ND MEETING OF THE FERTILISER'S
COMMITTEE HELD AT NEW DELHI IN FEBRUARY 1934.

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4. Existing condition of the fishing industry and its possibilities of development in so far as supplies of fish manure are concerned (Subject No. 6 of the Agenda).

Rao Bahadur Ananda Rao introduced the subject and explained that for some time there had been an unusual dearth of sardines in the West Coast and that the manure industry was consequently in a declined state at present. He then referred to the existence of certain extensive fisheries in certain seasons, of which the fishermen were totally ignorant at present on the East and West Coasts, some of which were not highly esteemed food fish and were therefore likely to provide raw material as fish-meal for food of livestock and manure for agricultural purposes. He therefore opined that unless the whole question was investigated and constant supply of fish over and above the food requirements was ensured, the availability of fish manure as a fertiliser would continue to be unsteady. He concluded by saying that (1) the research and investigations connected with the inauguration of deep sea fishing already started by the Madras Government should be continued in order to provide a steady and cheap supply of fish, and (2) a Fisheries bio-chemical laboratory should be established at Tanur Fisheries Station and the services of an expert Bio-Chemist should be entertained for a term of years for determining the best methods of manufacture. He added that owing to financial stringency, the Madras Government discontinued, as a measure of retrenchment, the survey by the trawler beyond March next and that the Council of Agricultural Research might enable the Madras Government to restart the experiments by providing funds as suggested by the Director of Fisheries in his note. Mr. Burt said that fish manure was a secondary product and favoured pointing out to Local Governments that the development of fisheries would augment the fertiliser supply as well as the supply of cattle food. Mr. Carpenter thought that unless fish manure could be had at a reasonable price it would be of no use taking any measures for its development. In his opinion, fish manure was twice as costly as any other equally effective manure. Rao Bahadur Ananda Rao said in regard to the high cost of fish manure that there was a time when it was cheap but the supply had been reduced in recent years with consequent increase in price. It could again be cheapened, if the supply could be increased. In regard to the latter point he said that there were large unexplored areas from Cape Camorin and all along the West coast up to Karachi and also on the coast of Burma and that if proper measures were taken the supply could be increased. Dr. Lander said that fish manure was a bye-product of the fish industry and favoured its development. Colonel Oliver said that he would rather support the taking of larger quantities of fish from the point of view of providing fish meal which is a valuable food for live-stock than as a means of producing fertiliser which was likely to be insufficient in quantity and too expensive except for local use. Rao Bahadur Sahasrabudde said, that experiments with fish manure had proved that it was better than sulphate of ammonia and favoured increase in the

supply of fish manure. Dr. Singh said that while he was convinced of the utility of fish manure in coastal tracts he doubted whether even in developed conditions the quantity would be sufficient to meet inland requirements. Rao Bahadur Ananda Rao said that there were large areas in which a fish industry could be developed. Mr. Carbery was of the opinion that there were several places in Bengal in which riverian fishery had been developed considerably and a fairly exhaustive enquiry had been made into the possibilities of deep sea-fishing. Rao Bahadur Viswanath suggested that he would like the Committee to support the proposition that fish manure was very useful and valuable. At the suggestion of Messrs. Burt and Pantulu the Committee recorded its opinion that on the information before it, fish meal was valuable both as a manure and as food for livestock and recommended its development by the provinces concerned.

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APPENDIX III.

NOTE, DATED THE 23RD JULY 1934, ON SUBJECT No. 10, APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF Rs. 92,487 SPREAD OVER A PERIOD OF THREE YEARS FOR A SCHEME FOR RESEARCH FOR IMPROVING THE FISHING INDUSTRY AND DEVELOPING THE SUPPLY OF FISH MANURE.

The Advisory Board at its meeting held on the 18th February 1933 considered an application from the Government of Madras for a grant of Rs. 92,487 spread over a period of three years for a scheme of research for improving the fishing industry and developing the supply of fish manure (Enclosure I.) As recommended by the Board (Extract from the proceedings of the meeting of the Board, Enclosure II) the scheme was examined by the Fertilizers' Committee of the Council. The Fertilizers' Committee has recommended the scheme on account of the high feeding and manurial value of fish meal subject to the condition that the Madras Government revives the measures previously adopted for the development of deep sea fishing. (Extract from the proceedings of the meeting of the Committee, Enclosure III.)

2. A note (Enclosure IV) dated the 27th March 1933 by Sir Frederick Nicholson and the reply to the Government of Madras thereto (Enclosure V) are enclosed for the information of the Board.

3. The subject is now for the consideration of the Board.

ENCLOSURE I.

APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF Rs. 92,487 SPREAD OVER A PERIOD OF THREE YEARS FOR A SCHEME OF RESEARCH FOR IMPROVING THE FISHING INDUSTRY AND DEVELOPING THE SUPPLY OF FISH MANURE.

Attention is invited to the attached letter from the Government of Madras, No. 3563-II|33-1, dated the 11th January 1933 (Annexure) regarding a scheme of research for improving the fishing industry and developing the supply of fish manure. The scheme which is fully explained in Mr. Slater's letter (Annexure) involves, in so far as the Council is concerned, an expenditure of Rs. 92,487 spread over a period of three years.

The subject is now for the consideration of the Advisory Board.

CHARAN DAS,

Secretary.

The 19th January 1933.

ANNEXURE.

LETTER FROM S. H. SLATER, Esq., C.M.G., C.I.E., I.C.S., SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 3563-II|33-1, DATED FORT ST. GEORGE, THE 11TH JANUARY 1933.

Fish manure—Research.

I am directed to forward a scheme of research for improving the fishing industry and developing the supply of fish manure for favourable consideration by the Imperial Council of Agricultural Research.

As the Council is aware, the Department of Fisheries in Madras has been engaged for some time in introducing improvements in the manufacture of fish guano, fish meal and fish manure. Prior to the investigations made by the department, the method of producing fish fertilizer was primitive in character and consisted in drying sardines in the sun on the sands of the open beach. This system had two drawbacks. Large quantities of valuable oil of no manurial value were lost and the manure became so highly impregnated with sand that analysis frequently showed the resultant mass to contain as much as 40 per cent. of this useless adulterant. Experiments were, therefore, undertaken at the Tanur station on the West Coast and had a speedy success. It was found that a simple and inexpensive plant could be devised to separate the oil and fertilizer effectively and profitably and the oil and the fertilizer so separated were of such good quality and fetched such high prices that numerous private factories came into existence on the Malabar and South Kanara coasts. Further experiments have shown that it is likely that a good proportion of the fish guano now used as a fertilizer will eventually be used more profitably as food for livestock, cattle pigs, dogs, poultry, etc. Success has already been obtained in producing fish meal on a small scale from all the common fish found on the West Coast. Samples of these were exhibited at the Wembley Exhibition and several enquiries followed for the supply of the meal in bulk. The conversion of 'scrap' (fish pressed for oil) into fish meal is more remunerative to the manufacturers and useful to the agriculturist than conversion into fish guano.

The processes now followed at Tanur for separating the oil and the fertilizer are, however, still empirical and crude. Much remains to be done by technological research to improve the quality of the oil and to develop the manufacture of guano and fish meal on approved scientific lines. The process of boiling and expressing the oil by hand presses which is now done at the Research station and in private factories is wasteful inasmuch as the proteins and other nitrogenous substances from the fish are lost in liquid form. The mechanical devices for manufacture of these products on a commercial scale have still to be improved so that production may be cheapened and quality standardized. Every step in the manufacture of oil and guano requires careful and detailed investigation and experiment. The degree of freshness of the fish required for high class manure and meal, the correct temperature for cooking, methods of cooking in closed or open vessels by steam or open fire, the period for which cooking should be continued, method of separation of oil without detriment to the quality or manure, the degree of dryage of scrap, etc.—all require detailed investigation and accurate experiment. Though general methods of manufacture are the same everywhere, details of the process therefore to be specially ascertained before the fish guano industry can claim to have attained even a reasonable degree of success. The perfection of the methods of manufacture, of fish meal referred to above, which is a more remunerative industry and one of considerable importance to the agriculturist in feeding livestock requires also the services of an expert Fisheries Chemist and Technologist.

The Tanur station as at present equipped and staffed is not competent to deal with any of the problems enumerated above. The Director of Fisheries proposes, therefore, that a bio-chemical laboratory should be

established at Tanur and the services of a competent and experienced Bio-Chemist should be engaged for a period of at least three years to begin with. As the research is of a highly technical nature, the officer to be recruited should be a technologist of wide experience and it is not anticipated that such an officer could be obtained for less than Rs. 1,200 per mensem. One of the Assistants of the United States Bureau of Fisheries with considerable experience in the manufacture of oil and guano who has actually patented improved processes and machinery, was interviewed by the Director in 1929 when he agreed to come to India for a short term of years but considered that a salary of Rs. 1,200 per mensem was the minimum which he could accept. It is understood that this officer, though he has since left the Bureau, will be available to undertake the proposed research at Tanur.

It will be convenient and economical to locate the laboratory at Tanur where there is ample accommodation for the Technologist, his staff and his laboratory. It is considered that if the experiments prove as is expected, a success, the laboratory will be required as a permanent measure and it will then be necessary to have a suitable Indian specially trained in charge of the work. To that end, it has been suggested that a Chemistry Honours Graduate of an Indian University of approved merit and high academic qualifications should be recruited at once on an initial salary of Rs. 200 a month. In order to enable him to acquaint himself with local conditions and specific problems relating to Indian fish oil and manure industry he will be deputed for a period of one year to visit the private oil and guano factories on the coast and to work under the immediate control and guidance of the expert at the Tanur station. After a preliminary study and training he should be deputed to America, for an advance course of bio-chemistry with special reference to fish oil, guano, and fish meal manufacture for a period of one year. The deputation to America is proposed as it undoubtedly offers the best facility for study and training to Indian students. In America, the student will visit the Atlantic and Pacific coasts, where two different kinds of fish are used in the industry. On his return at the end of the second year he will resume his work under the expert, the intention being that he should eventually succeed the expert. During the one year when the student will be away on training the expert will need the assistance of a suitable well-trained assistant of the department. An assistant on Rs. 70—250 will therefore be attached to the expert during the second year of the recruit's training abroad.

The total cost of the scheme is as shown below :—

Non-recurring.

	Rs.
Apparatus, chemicals, etc., for the laboratory ..	10,000
Furniture and fittings	1,500
Site, buildings, plants, laboratory and office ..	39,120
Total ..	50,620

Recurring.

	Rs.
Pay of Bio-Chemist at Rs. 1,200 a month	43,200
Pay of Research Assistant at Rs. 150 (one year) ..	1,800
Pay of laboratory assistant on Rs. 65—125	2,484
Pay of clerk on Rs. 35—60	1,278
Pay of peon on Rs. 12—18	432
Contingencies	3,000
Apparatus and chemicals	3,000
Travelling allowance	3,000
Passage of the expert	3,500
Total	61,694

To the above expenditure will be added the cost of training of an Indian candidate as shown below :—

	Rs.
Pay at Rs. 200 (for 12 months)	2,400
Travelling allowance in India	1,000
Charges on account of the candidate going to America for a period of one year at 2,000 dollars	8,500
Pay for the third year on return at Rs. 230	2,760
Passage to and from America (£160)	2,138
Travelling allowance in America	2,500
Total	19,298

The scheme as explained above was placed before the Provincial Research Committee and has been approved by it. The contribution of Madras Government towards the cost of the scheme will be the cost of buildings, site, etc., estimated at Rs. 39,120 and included under non-recurring expenditure shown above. The continuance of the Tanur station has at present been sanctioned only up to 31st March 1934, and even if they decide to discontinue the work now done there after this date they would have no objection to allow the use of the buildings, laboratory, etc., for the conduct of the proposed investigation. The scheme is of importance not only to Madras but to all India. The Government of Madras attach great importance to the development of fish manure industry and I am to express the confident hope of His Excellency the Governor acting with his Ministers that the scheme will receive the sympathetic consideration of the Imperial Council of Agricultural Research.

ENCLOSURE II.

EXTRACTS FROM THE PROCEEDINGS OF THE ADVISORY BOARD, SEVENTH MEETING, FEBRUARY 1933.

Application from the Government of Madras for a grant of Rs. 92,478 spread over a period of three years for a scheme of research for improving the fishing industry and developing the supply of fish manure (subject No. 14 of the Agenda).—Dr. Sundar Raj, in explaining the scheme, said that there was a certain amount of fish manure that was now produced in the country but nothing like as much as could be produced. The Madras Fisheries Department had substituted a simple plant for extracting the oil and crushing the residue into a decent fish manure for the oil crude form of beach drying but technological research and the application of modern methods was called for. Mr. Ramamurthy said that the scheme had been carefully considered by the Provincial Research Committee. It had been suggested that, instead of appointing an American Expert on Rs. 1,200 per month as proposed in the scheme, a capable Honours Graduate might be selected in India and sent to the United States or Norway where he would be trained for a couple of years and then take up the work on his return. The cost of such a scheme would have been Rs. 58,000 as against Rs. 80,000 so that there would have been a saving of over Rs. 20,000. But then there was the objection that we should be wasting a couple of years. If a capable Bio-chemist could be obtained immediately he would be able to carry on the work during the next two years, also and by having an Assistant working under him in the first year who would be sent to the United States in the second year and come back in the third year. A well-trained Indian would be secured who would be able to continue the work after the expert had left. The Provincial Research Committee therefore thought that it would be better even with an additional expenditure of about Rs. 20,000 to have a Bio-chemist straightaway. But if on the ground of expense the Advisory Board felt that it was desirable to postpone the scheme till a suitable Indian had been trained the Madras Government would not be unwilling to consider this point. They however felt that it was much better to start the scheme immediately, in order to get results of economic value. Considering the great value of manure in the improvement of produce from poor land in Malabar and the comparative poverty of its people the addition of this industry would be directly beneficial to the fishermen and indirectly to the agriculturists in that province. In this way Mr. Devadhar justified the expenditure incurred in launching the scheme. Mr. Plymen was of the opinion that the scheme was an expensive one and did not involve fundamental research. He was also not convinced of the need for the importation of a man from outside. In answer to Dr. Nazir Ahmad, as to the crops for which fish manure was used and the resulting increase in yield, Mr. Ramamurthy said that fish manure was largely used on the West Coast and was probably as good as super-phosphate. He also stated that the work could not be done at Bangalore, as suggested by Mr. Plymen, for the reason that Bangalore was situated inland, whereas the material required for this research could only be had at the sea coast. Dr. Ghosh said that the subject was no doubt important specially the better extraction of fish oils and it should be tackled immediately. He suggested that the work could be done at a much less cost by collaborating with the University of Madras. Mr. Carpenter referred to a resolution proposed by Dr. Hyder-

at the last meeting of the Advisory Board limiting the amount of money that a scheme should cost and pointed out that this scheme exceeded that amount. He, therefore, felt that the Board would need very good reasons for supporting the scheme. Another matter that needed consideration was whether the scheme was of an all-India importance. Mr. Stewart pointed out that it was proposed in the scheme to recruit a Graduate in Chemistry who would be paid Rs. 200 per mensem while in India but when he went to America he would draw over Rs. 700. He thought that if the man was given a scholarship of £250 a year that would reduce expenditure automatically by about Rs. 5,000. Mr. Burt was not satisfied with the all-India aspect of the scheme and for that reason he suggested that the scheme with the discussion at the present meeting be referred to the Fertilizers' Committee for examination and report to the Advisory Board. It was just the kind of scheme which that Committee should consider. The Board then decided to refer the scheme to the Fertilizers' Committee for examination and report.

ENCLOSURE III.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE FERTILIZERS' COMMITTEE HELD ON THE 28TH FEBRUARY 1934.

14. *Application from the Government of Madras for a grant of Rs. 92,487 spread over a period of three years for a scheme of research for improving the fishing industry and developing the supply of fish manure (Subject No. 15 of the Agenda).*

Rao Bahadur Ananda Rao introduced the scheme and referred to the note by Sir F. A. Nicholson which criticised the Madras Government scheme. He then answered the various points which had been raised by Sir F. A. Nicholson. The Advisory Board had raised two points of criticism: one was about the high cost of the scheme and the other about the scheme not being of an all-India importance. As regards the first, Rao Bahadur Ananda Rao stated that an expenditure of Rs. 30,000 per annum on an industry which yielded on an average about Rs. 14 lakhs per year in Madras alone was not high. With regard to the second point, he said that the scheme was designed primarily to help Madras but any practical results achieved would be of interest to other Maritime Provinces. Dr. Singh was not convinced that the scheme was of an all-India importance. Besides, the cost of transport of the article, if it was a bulky article, to other provinces was not a negligible factor and had to be taken into account. Rao Bahadur Viswanath explained that it would not be a bulky manure but a concentrated article and its transport charges would not be very heavy. Colonel Oliver was of the opinion that if the Local Government would undertake to continue their deep sea fishing experiments then it was worth while sanctioning the present scheme. In the end, the Committee decided to recommend the scheme on account of the high feeding and manurial value of fish meal and fish manure but subject to the condition that the Madras Government revived the measures previously adopted for the development of deep sea fishing.

ENCLOSURE IV.

Note by Sir F. A. Nicholson, dated the 27th March 1933.

It is proposed to spend Rs. 1,20,000 in the next 3 years on (1) employing an American bio-chemical expert to deal with the oil and guano (and probably fish meal) industries of the Madras coast, (2) enlisting and training an Indian Science Graduate as a bio-chemist, by special training under the above expert and in America; (3) on a bio-chemical laboratory at Tanur.

This expenditure is unnecessary and unwarranted. (1) The catches of the oil sardine (and of mackerel) used for the oil and guano industry are extremely precarious, intermittent, and scattered over 250 miles of coast ; in many consecutive years the fish available—after supplying the food trade—for these purposes is quantitatively negligible or almost wholly absent ; in the last ten years there has been but a very small margin except in 1923-24 and 1924-25 : the previous decade also showed frequent grave shortage of the shoals. In the last six years oil and guano have been made only in small quantity. Save in exceptional years the manufacture is on a small scale.

(2) The oil made at Tanur is already first class : has been described by a British oil firm as " unique " : it is of a fine pale yellow colour, almost inodorous and tasteless, singularly free from acidity, and of the best saponification and iodine values. It is found excellent for fine leather work, was habitually used in canning sardines which is enriched, and used in quantity at hospitals : no further refinement is needed. It is only the oil from *private factories* that is of low class, and it is for Tanur to teach these private manufacturers.

(3) A bio-chemist is not needed for dealing with these fish oils ; only some mechanical skill and some knowledge of ordinary chemistry.

(4) If any further researches or refinement is necessary, there is a *regular oil-chemist* (Mr. A. K. Menon, F.C.S.) at *Calicut*, who had a full training under Dr. Lewkowitsch in London and has since been working as Government oil chemist and soap maker ; he has a laboratory which could easily be added to. There are also great laboratories at the Agricultural College, Coimbatore, and the Imperial Research Institute at Bangalore with chemists and plant of the first rank.

(5) As regards fish guano, the Tanur outturn is fully equal to the U. S. A. and Japanese fish guano ; it has less moisture, and is equal or better in nitrogen and P_2O_5 . See my Bulletin on the manufacture of fish oil and guano : the only further Tanur problems are those of more powerful presses and the disposal of the effluent water. What remains to be done is the teaching of Tanur methods to the *private factories* which have to be remodelled, and where possible, steam introduced *for boiling*, not necessarily for power. For better oil and guano from the private factories it is advisable to reduce the number of petty factories, and to induce the amalgamation of factories for working Tanur methods under co-operative principles.

Fish meal.—The ordinary Tanur guano has been quite successfully used, and been well reported on, as cattle and poultry food, without any alteration except grinding. Neither this nor fish meal for human consumption needs the employment of a bio-chemist. All can be done by the existing staff, recruited, if necessary, by a special Assistant. At present the manufacture of fish meal for *human* consumption is hardly important, since fish, suitable, like cod, etc., for mealings, are not ordinarily abundant at the numerous fishing stations so that the supply is taken up by the fresh fish trade and by ordinary curers ; moreover it is questionable whether ordinary curing, if improved, is not preferable to fish mealings ; fish, such as varian, have considerable content of oil, and this is relished by the public and is very valuable nutritionally ; the fish of this sort on the Tanur dry-

ing flakes frequently dripped with oil and took on the brownish discoloration approved by the Indian market as an evidence of fatness. Fish meal, however valuable as concentrated food, readily preserved from taint, and easily transported and stored, will become an important item of manufacture only when improved methods of capture and treatment in the fishing boats, brings about a useful surplus. Finally, the problems connected with fish mealings do not at all require a bio-chemist, but only a practical man ; the one trouble in manufacture is the excess of oil which impedes mealings, tends to cause rancidity on storage, and is supposed to be undesirable nutritionally, a supposition entirely doubtful as regards human. In any case these difficulties do not at all require a bio-chemist. It is clear that for animal consumption the excess oil cannot be removed by chemical solvents ; hence only boiling (or steam heating) and pressure are left ; the methods can readily, and best, be examined by a practical man accustomed to dealing with fish as food, with, if necessary, the aid of dieteticians and nutritionists ; e.g., in such matters as the addition of part of the bone and (glutinous) skin, the mixing of the meal with cereals, etc., either in powder or as compressed dry cakes, and so on. A well-educated man accustomed to a fish yard, e.g., at Tanur and acting on the advice of nutritionists, can and should deal with all these problems.

F. A. NICHOLSON.

The 27th March 1933.

ENCLOSURE V.

COPY OF A LETTER NO. 2494-II/33-2, DATED THE 13TH FEBRUARY 1934, FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

The Madras Government understand that their scheme of research for improving the fishing industry on the West Coast forwarded to the Council with Mr. Slater's letter No. 3563-II/33-1, dated 11th January 1933, has been referred to the Fertilizers' Committee which will meet towards the end of this month. They find attached to the note circulated to the members of the Committee a note by Sir F. A. Nicholson, dated the 27th March 1933, criticising the scheme. Copy of this note has not been sent to this Government either by the Council or by Sir F. A. Nicholson ; but Sir Frederic was, on request, supplied with a copy of the Local Government's letter of 11th January. He offered some remarks on the proposals made by this Government and they were considered in consultation with the Director of Fisheries ; in the light of information furnished by the Director of Fisheries the Local Government did not consider it necessary to withdraw the scheme. A copy (enclosure) of the Director of Fisheries' letter in answer to the criticisms of Sir F. A. Nicholson is enclosed and I am to request that it may be placed before the members of the Committee at their meeting so that all aspects of the case may be carefully considered by them.

ENCLOSURE.

COPY OF A LETTER REF. NO. 2804-E/32, DATED 15TH OCTOBER 1933, FROM THE DIRECTOR OF FISHERIES, MADRAS, TO THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT.

Improvement of Fish Manure industry—Scheme forwarded to the Imperial Council of Agricultural Research—Reply to criticisms.

Reference.—Government Memorandum No. 2494-II/33-1, dated 29th August 1933.

In replying to the criticisms made of the scheme of technological research on fish manure formulated by Government at my instance, it is necessary to deal with the three

products with which the scheme is directly concerned, *viz.*, Fish-oil, fish-guano and fish-meal. Though fish-guano is the manure, fish-oil is a necessary by-product of great commercial value without which the guano industry cannot thrive. Moreover fish-oil being a valuable medicinal and edible substance is of considerable importance as food for man and farm stock and is directly useful to the agriculturists. Fish-meal is a more valuable product manufactured from the same raw material, "scrap" (pressed fish) from which the less valuable fish-guano is produced.

Fish-Oil.

Prior to the experimental work of the Fisheries Department in 1908, the amount of sardine oil produced on the west coast was inconsiderable and of the worst possible quality. The usual method was to obtain the oil by the putrefaction of a mass of sardines contained in a worn out and filthy dug out canoe. It was also a wasteful process for the proteid and other residues were thrown into the sea. The experiments made by the Department had unexampled and swift success. It was found that a simple and quite inexpensive plant could be devised to separate the oil and the fertilizer effectively and profitably. Sir Frederick Nicholson in his report "Manufacture of Fish Oil and Guano" published in Madras Fisheries Bulletin XIII (1921) has summed up the results of his investigations at Tanur. Though a valuable popular account of the state of the fish-oil and guano industry at the time and an excellent compendium of highly useful and practical methods and recipes, it does not claim to be a scientific treatise. The biological, chemical and physical changes on which the methods are based are not scrutinized or explained and chemical analysis of the processes involved in the various stages of manufacture were not made, possibly because little was known at the time of the bio-chemistry of fish-oil and guano and empirical methods gave results acceptable to the markets. Subsequent research at the Tanur Experimental Station and the phenomenal advance during the last decade in fish-oil and meal technology and bio-chemistry which has revolutionised the methods of the European, American, and Japanese industry however showed that systematic scientific research on up-to-date lines was essential to the progress and prosperity of the Malabar industry, started through the far-sighted initiative of Sir Frederick Nicholson. I mention below a few items of work at Tanur since 1923 as examples and enclose a recent publication of the Biological Board of Canada on the Industrial chemistry of fish-oils, which are sufficient to show why advanced bio-chemical research has now become essential. It should be noted that almost every reference in this Bulletin is to literature subsequent to 1919.

One of the uses for fish-oil prepared according to Sir Frederick Nicholson's methods as stated by him is as a substitute for cod-liver oil, pilchard oil, etc., *vide* paragraph 3 of page 204 of his report. Some manufacturers on the west coast on the strength of this pronouncement placed the oil on the market and solicited testimonials from the department. As no bio-chemical tests had been made regarding the Vitamin A contents of the Malabar sardine oil at any time, it was impossible to declare that even the finest Malabar oil manufactured and classed A 1 by Sir F. A. Nicholson contained all or any of the medicinal properties of cod liver oil. This caused considerable dissatisfaction to the manufacturers concerned. The feeding tests in hospitals instituted by Mr. Hornell as Director after Sir F. A. Nicholson had also produced dubious results, *vide* paragraph 21 of the Annual Report for 1924-25. Bio-chemical and calorimetric tests of the oil subsequently made at my request by the well-known authorities, Prof. Hjort of Norway and Prof. Drummond of London in 1925 and 1926 confirmed my view that the best sardine oil, as at present manufactured on the West Coast, contains little or no vitamin A and cannot be substituted for cod liver oil, *vide* paragraph 21 of my Administration Report for 1926-27 and page 763, paragraphs 3 and 5 of the Madras Legislative Council Proceedings, Fourth Session, Volume XXIV—March, 1926. The professors recommended a scrutiny of the methods of manufacture but Tanur has neither the staff nor equipment for such an investigation. It may be stated here that cod liver oil has been long superseded by other fish-oils notably halibut oil which has been found to have a far greater vitamin potency. It is not, therefore, unlikely that the empirical methods of manufacture now followed are at fault. When scientifically scrutinised some of our fish-oils like the halibut oil may prove to be equal or even superior to cod liver oil. This will lay the foundation of a new paying industry. Please see pages 94 to 97 of the Canadian Bulletin enclosed.

The second purpose for which the Malabar sardine oil is recommended by Sir F. A. Nicholson is as an edible (*vide* paragraph 4 on page 204 of his report). The only use as

food mentioned by Sir F. A. Nicholson was as a packing oil in fish canning. He also mentions domestic use of similar oil in Japan. The best sardine oil grade A 1 produced by processes described in the bulletin, however, are unfit through colour, smell and taste for ordinary domestic use even in this country. Refining methods following the rapid advance in bio-chemistry during the last decade have been so perfected in other countries that fish-oil which is the cheapest animal oil in the world has been rendered so colourless, odourless and tasteless that it has come into use as an edible oil for all domestic purposes as a substitute for margarin butter, salad oils, shortenings, confectioner's fats, etc. A recent enquiry in Bombay disclosed the fact that nearly 60% of the butter and ghee sold in that city consisted of fish oil so refined as to be undetectable (*vide* page 155 "Allahabad Farmer", Volume VII, No. 4, July 1933). There is no comparison between the price of the fish-oil, produced on the west coast and that of the same oil when refined by up-to-date methods into an edible oil and the profit is now going exclusively to Germany and Japan where the Malabar Oil is refined. It is true that such a use was not even conceivable a decade ago but the Malabar industry has to face competition and must march with the times if it is to prosper (*vide* pages 87 to 94 of the Canadian Bulletin enclosed).

The third use for which the Malabar sardine oil is advocated by Sir F. A. Nicholson is for industrial purposes. All the industrial uses to which the Malabar oil is put enumerated in paragraph 2 on page 149 of his report, are (1) for leather dressing, (2) for "browning" rifle stocks, (3) for caulking and smearing country craft, (4) for batching jute, (5) for the manufacture of insecticidal soap. They are, however, very few and insignificant compared with the many uses for which fish-oil manufactured and refined by modern methods is now employed in various industries (*vide* pages 97—118 of the Canadian Bulletin enclosed). The bulk of the oil now manufactured in Malabar is too crude and of too uncertain quality for industrial uses other than those specified by Sir F. A. Nicholson. Modern refining processes discovered by recent bio-chemical research have to be applied to the Malabar fish-oil if its industrial possibilities are to be ascertained and exploited.

Fish-Guano.

Of the three products guano or manure is perhaps the least susceptible of improvement. Even so there are glaring defects in the process of manufacture adopted in Malabar. The high fat content (paragraph 3 on page 184 of Sir F. A. Nicholson's report) is a serious defect both in reducing the manurial value of the guano and in the loss of valuable oil. This is further dealt with under Fish-meal. Another defect is that no satisfactory method of securing the substances lost in solution with the "effluent water" has been found—*vide* pages 206—209 *idem*. Far simpler and more effective methods of utilising this waste and enriching the guano than are suggested in the report are now available for the industry if their application is investigated at Tanur. Guano, however has now been superseded by fish-meal in importance.

Fish-Meal.

The manufacture of fish-meal is entirely a postwar development and the experimental work of Sir F. A. Nicholson summarised in the bulletin quoted above concludes that "It has not been found possible to experiment with fish-meal in this country"—paragraph 1 on page 196.

Since then however as a result of a series of experiments, conducted at the Tanur Station, it has been possible to manufacture fish-meal. There is demand for the meal in hundreds of tons from England. Locally also the demand is steadily increasing to an extent that already Tanur is unable to meet it. There are grave defects in the process of manufacture which cannot be remedied except by careful bio-chemical research. To mention only one of them, the high fat content of the meal precludes its sale in European markets and its proper storage for long periods. The proposed research at Tanur is particularly required for perfecting this highly valuable product. The "scrap" converted into guano or manure fetches only Rs. 80 to Rs. 100 per ton on an average. If converted into meal it fetches annas 4 per lb. or Rs. 560 per ton. While chemical and other substitutes for fish manure are available in the market and serve to keep the price of fish manure low, there is no possible substitute for fish-meal as animal feed and hence its high value to the manufacturer and the agriculturist. Even for the one purpose of perfecting the

process of fish-meal manufactured the scheme formulated seems worthwhile. The industrial process of manufacture of the meal, however, includes extraction of oil and utilisation of any refuse as manure and any research on fish-meal is therefore bound to benefit the other two lines of manufacture incidentally.

The proposed research has been criticised as too expensive specially in view of the great fluctuations in the sardine and mackerel fisheries of the Malabar coast. I give below 10 years statistics of the value and output of the west coast industry (figures for fish manure for the best year 1922-23 are not available).

Year.	Fish-guano.		Fish manure.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	Rs.	Tons.	Rs.
1922-23	32,000	24,00,000	..	..
1923-24	22,500	13,50,000	17,000	6,80,000
1924-25	4,000	4,25,000	1,000	1,00,000
1925-26	9,850	7,50,000	1,000	70,000
1926-27	2,100	2,52,000	2,100	2,10,000
1927-28	850	95,000	10,000	10,00,000
1928-29	1,100	1,10,000	15,000	7,50,000
1929-30	223	24,530	730	73,000
1930-31	65	4,550	110	4,000
1931-32	71	5,325	840	50,400
	72,759	54,16,405	47,780	29,37,400
Fish-guano plus fish manure .. .. .	..	..	Quantity.	1,20,539 tons.
			Value	Rs. 83,53,805
Average per year .. .. .	..	..	Quantity.	12,054 tons.
			Value.	Rs. 8,35,380

In spite of the several unfavourable sardine seasons which is unusual, in the last 10 years, and the absence of figures for fish manure in 1922-23, the average annual value of the industry amounts to no less than 8½ lakhs and this in spite of the admittedly undeveloped state of the fishing and guano industries and the crudity of the products. The average annual cost of the investigation proposed for three years is only Rs. 30,829, or roughly one-twenty-seventh of the average annual value of the industry. Considering the immense benefits that the research will confer on the industry I submit that the expenditure is amply justified especially as it is the Imperial Council of Agricultural Research who are anxious to develop the industry and it is at their request I examined the need for research.

As regards fluctuations, this is nothing peculiar to South Indian fisheries. All fisheries throughout the world are subject to more or less similar variations from year to year.

I have not touched on an even more recent development in the fish manure and meal industry that is bound to have far-reaching results for Madras Fisheries and Agriculture. The Indian Seas except in a few favoured places like Karachi are comparatively barren of sea-weed. On about 200 miles of the East Coast from Tuticorin to Point Calimere, however, there is an enormous growth of sea-weed of many kinds. Judging by what is

washed ashore all along this coast during the south-west monsoon it is no exaggeration to say that the quantity of raw sea-wood available for collection will not be less than some hundreds of thousands of tons in a season. A recent process of meal manufacture is to grind up in certain proportions cheap raw fish and fish refuse of all kinds with sea-weeds under controlled conditions of dryage, when it is stated to become a most nutritious food for farm stock and a rich manure for crops. Experiments have only just begun. Here as in all the other lines of manufacture the services of a Bio-chemist and Technologist will be invaluable.

In the foregoing paragraphs I have briefly stated the case for the research scheme which Government decided to forward to the Imperial Council of Agricultural Research. Two decades ago little was known of bio-chemistry as a science and still less of its industrial application in the field of fishery technology. Nevertheless thanks to the praiseworthy efforts of Sir. F. A. Nicholson a great deal was accomplished during the fifteen years of his tenure of office 1905 to 1920 to develop fishery industries with the available knowledge and methods. The practice followed was no doubt "sound in principle" and "excellent in results" according to the standards then prevailing. But the methods and processes, necessarily empirical, considering the limitations under which Sir F. A. Nicholson worked, have become for the most part obsolete as explained above in the light of modern bio-chemical research. The enormous post-war developments in bio-chemistry and fishery technology now render it imperative that the methods and processes determined by his early experiments should be scrutinised, revised and replaced where necessary by new and more scientific methods by a qualified technologist. Failing this not only will the product remain crude and the industry become unremunerative, but in the absence of a thorough scientific basis it will be impossible to vouch for the efficiency of any processes or recommend them to the trade and public. Propaganda for the introduction of methods of manufacture in any industry presupposes sure and certain knowledge of an up-to-date character which alone can guarantee successful results.

It is stated that what is needed is not scientific research but "introduction of Tanur-plant and methods into the numerous petty factories, co-operative action being indicated." An intensive departmental propaganda from 1908 onwards led to the establishment of hundreds of factories on the west coast on the model of Tanur. By 1922-23 one of the most favourable sardine seasons on record, the number of factories rose to a maximum of 647. Although propaganda continued for some years subsequently there was no material increase in the number of factories. Any further multiplication of factories by propaganda or demonstration did not seem necessary as several of the existing ones even now close down in an unfavourable fishing season and there is no doubt that the trade is fully aware of the possibilities of this industry thus far developed and is only too eager to increase the number of factories should there be prospects. The three divisional Inspectors on the West coast who took over the duties of the Oil and Guano Inspector in 1924-25 and the Research Assistant at the Tanur Station have continued to demonstrate and instruct the interested public. Almost every year applications are received for apprenticeships at the Tanur Station. Several Government officers belonging to other provinces and States as well as private factory Managers, have received their training at Tanur. Even this year there are 3 apprentices under training. Whatever processes have been perfected at Tanur have been passed on to the industry. Further propaganda must await research and experiment on up-to-date lines. From the above account of the stage reached in the oil, guano and meal industry in this province and the advanced state of the industry in other countries, it is clear that what the industry needs at present is not propaganda so much as the revision and perfecting of the processes on modern lines which will secure adequate profits to the manufacturer and benefits to the country at large and enable local manufacturers to compete with the foreign produce in the market.

The very considerable collateral benefits expected to accrue by the establishment of a bio-chemical laboratory and the appointment of a qualified staff in the matter of improving and developing other fishery industries such as fish curing, refrigeration, preservation of fishing craft and tackle and the manufacture of many minor marine products in which Tanur is engaged, have not been referred to here as they are outside the scope of the present reference.

APPENDIX IV.

NOTE, DATED THE 29TH AUGUST, 1934, ON SUBJECT No. 11, QUESTION OF THE NEED FOR AN ALL-INDIA FERTILISERS ACT.

Attention is invited to the attached note dated the 3rd January 1934 (Annexure I) on the subject mentioned above which was circulated to the Fertilisers Committee of the Imperial Council of Agricultural Research at its meeting held in February 1934.

2. The Committee after considering the matter came to the conclusion (Annexure II) that the matter should be put before the next meeting of the Advisory Board with the views of the members of the Committee expressed at the meeting. The Committee also recommended that members from each province should go into the practicability of a law insisting on labels stating the composition of the manure and the desirability of prohibiting ready-made mixtures of unstated composition and that their views on this point and the views of Fertiliser Manufacturers in India which the Committee desired should also be obtained as far as possible be placed before the Board.

3. The views of the members of the Committee and of some Fertiliser Manufacturers on the point mentioned in paragraph 2 of this note will be found in Annexure III.

4. The subject is now for the consideration of the Advisory Board.

 ANNEXURE I.

NOTE, DATED THE 3RD JANUARY 1934, ON SUBJECT No. 5, QUESTION OF THE NEED FOR AN ALL-INDIA FERTILISERS ACT.

At its first meeting held in June 1930, the Fertilisers Committee considered the question whether an All-India Fertilisers Act was needed. The Committee was provisionally of the opinion [*vide* paragraph 5 of the proceedings of the meetings of the Committee held on the 17th June 1930 (Extract enclosed)—(Enclosure I)] that an All-India Act was necessary, but recommended that before the next meeting of the Committee when the question would be further considered, the representatives of the various provinces should examine the necessity for an All-India Act

2. Members of the Committee were accordingly requested to examine the question in detail and to forward any definite evidence which they might have of the need for an All-India Fertilisers Act. A copy of the replies received will be found in Enclosure II. The question was also examined by the Secretariat of the Council in the light of such information as was available on the subject in (i) the proceedings of the meetings of the Board of Agriculture and the action taken by the Government of India thereon, (ii) the report of the Indian Industrial Commission and (iii) the evidence tendered to the Report of the Royal Commission on Agriculture in India.

3. The replies received from the members of the Committee go to show that the case for a Fertilisers Act is no stronger now than when the

Royal Commission on Agriculture in India reported. It may be observed that in paragraph 94 of their report the Commission stated as follows in regard to the desirability of undertaking legislation against adulteration of fertilisers. " We have received no evidence of its existence apart from certain complaints from Bengal regarding oil cakes. We recognise that the absence of complaints except in this one instance is no evidence that adulteration does not exist. That a certain amount of adulteration does exist in the case of fertilisers supplied through local bazaars to small cultivators is in fact probable. All that can be said is that the practice does not at present exist on any considerable scale ". It may also be noted that a premature action in the direction of the legislation suggested by the Committee is fraught with some danger, *viz.*, the sale of manures is insufficiently organised at present and there are not enough retailers and if in the circumstances the liabilities of a shopkeeper who sells manures are increased by the passing of an Act, this may have the effect of discouraging him from stocking and retailing such manures as oil cakes, ground bone, etc., at village centres. On the whole, the position appears to be that there is no evidence of public opinion in favour of or any serious need for an All-India Fertilisers Act. It is therefore thought that what is required at the present stage is to teach those ryots who buy artificial manures, to demand a certificate of composition of the manure.

4. The subject is for the consideration of the Fertilisers Committee.

ENCLOSURE I.

Extracts from the Proceedings of the Meeting of the Fertilisers Committee held on the 17th June 1930.

* * * * *

5. Mr. Ramadas Pantulu said that he would like the Committee definitely to recommend the passing of a Fertilisers Act in India ; Messrs. Viswanath, Allan, Milne, Sethi, Sahasrabuddhe and indeed all members of the Committee who had had experience of the matter had complained about the adulteration of artificial manures. It was now no longer the case as was stated by the Royal Commission on Agriculture when they advised against the passing of such an Act that the opportunities for adulteration in India were rare and that there were no complaints in this matter. Dr. Harrison said that if India had a Fertilisers Act there would be no danger from mixtures as firms would have under the Act to give a guaranteed analysis to purchasers. Mr. Burt referred to the Agricultural Journal published by the English Ministry of Agriculture which gave the unit values of various manures. This provided a safeguard to purchasers who could from the tables given in the Journal find out exactly what they were paying for. Something similar might be adopted in India.

The Committee, while provisionally of the opinion that an All-India Fertilisers Act was necessary, recommended that, between now and its next meeting when the question would be further considered, provinces should examine the necessity for an All-India Act.

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ENCLOSURE II.

LETTER FROM MR. G. R. HILSON, B.Sc., OFFG. DIRECTOR OF AGRICULTURE,
MADRAS, R. O. C. No. D-1935/30, DATED THE 9TH DECEMBER 1930.

With reference to your letter No. 2439-Agri., dated the 18th November, I have the honour to state that I do not know whether there is any need for an All-India Fertilisers Act, but that I have put up proposals to the Madras Government, for the passing of a Madras Fertilisers Act, a copy of which I enclose.

2. We have discovered that manures have been purchased from reliable manure firms and sold again by the purchasers to cultivators at rates lower than that demanded by the original suppliers. This can mean either that short weight is given or that the manure is adulterated with some cheap and probably useless article before resale. Again other manures have been advertised as containing certain ingredients which on analysis they do not contain. Further we feel that there is need that manures like bone meal should be sold on a definite guarantee of fineness.

At the present moment bone meal is sold as bone meal and may be anything from finely crushed bones, or a meal of which about 80 per cent. would pass through a 100 mesh sieve.

3. One or two cases have come to our notice of bone meal being supplied which is definitely a mixture of bone meal and a mineral phosphate. It is not certain in all these cases that the mixture has been deliberate but it is certain that the passing of an Act would make firms more careful in their dealings.

THE MADRAS FERTILISERS ACT, 1931.

Whereas it is expedient to take measures to prevent the adulteration of fertilisers, it is hereby enacted as follows :—

(1) *Short title, commencement, repeal and extent.*—This Act may be cited as the Madras Fertilisers Act, 1931, and will come into operation on such day not earlier than the first day of nineteen hundred and as may be appointed for the purpose by the Government.

(2) This Act will extend throughout the Madras Presidency.

Civil Liabilities.

1. *Obligation to furnish statutory statements.*—(1) It shall be the duty of every person who sells for use as fertilisers of the soil any article included in the first column of the First Schedule to this Act, whatever may be the name under which the article is sold, to give the purchaser on or before delivery, a statement in writing (hereinafter referred to as a 'statutory statement') in such form (if any) as may be prescribed, containing the following particulars :—

(a) the name under which the article is sold ;

(b) such particulars (if any) of the nature, substance, or quality of the article as are in relation to the article mentioned in the second column of such schedule :

Provided that the obligation so imposed shall not apply—

- (i) to sales of two or more articles which are mixed at the request of the purchaser before delivery to him ;
- (ii) to sales of small quantities (that is to say, sales in quantities of fifty-six pounds or less), if the article sold is taken in the presence of the purchaser from a parcel bearing a conspicuous label on which are marked in the prescribed manner the particulars required by this section to be contained in the statutory statement.

(2) Failure to give a statutory statement in accordance with the provisions of this section shall not invalidate a contract for sale.

2. *Warranties*.—(1) A statutory statement given by the seller of any such article as aforesaid shall, notwithstanding any contract or notice to the contrary, have effect as a written warranty by the seller that the particulars contained in the statutory statement are correct.

(2) Where an article sold for use as a fertiliser of the soil is in a statutory statement or other documents described by a name specified in the first column of the Second Schedule to this Act, the sale of the article under that name shall have effect as a written warranty that the article accords with the definition thereof contained in the second column of that schedule.

(3) Any statement as to the amount of chemical or other ingredients or as to the fineness of grinding of an article sold for use as a fertiliser of the soil, which is made after the commencement of this Act in any written document (other than a statutory statement) descriptive of the article shall have effect as a warranty by the seller that the facts stated are correct.

(4) No action on any such warranty as is mentioned in this section shall lie for any mis-statement therein as to the particulars of the nature, substance or quality of the article or as to the amount of any ingredient where the mis-statement does not exceed the limits of variation (if any) prescribed under this Act in relation to such particulars or amounts but where the mis-statement exceeds such limits, the rights of the purchaser under the warranty shall not be affected by such limits.

3. *Right of purchaser to have article sampled and analysed*.—(1) The purchaser of any article included in the first column of the First Schedule to this Act, or of any fertiliser not included therein in respect of which a warranty, express or implied, has been given by the seller, shall, on payment of such fee (if any) as may be fixed under this Act, be entitled to have a sample of the article taken by an official sampler in the prescribed manner and analysed by the Agricultural Analyst, and to receive from the Analyst a certificate of the result of his analysis :

Provided that a purchaser of an article who requires a sample to be taken under this section shall, if so requested, furnish to the official sampler who takes the sample the statutory statement or warranty relating to the article, or a copy thereof.

(2) A sample taken under this Act by an official sampler at the request of a purchaser shall be taken in the prescribed manner, and shall

not be taken after the expiration of fourteen days from the delivery to the purchaser of the article sampled, or the receipt by the purchaser of the statutory statement or warranty, whichever date may be the later.

Criminal Liabilities.

4. *Marking of articles prepared for consignment.*—(1) Every parcel of an article included in the first column of the First Schedule to this Act when prepared for sale or consignment for use as a fertiliser of the soil shall, if exposed for sale, or, if not exposed for sale, before being removed from the premises where it is so prepared, be marked in the prescribed manner with a mark or marks stating or indicating the particulars required by this Act to be contained in the statutory statement.

(2) Any person dealing in any such parcels may for the purposes of this section keep in such form (if any) as may be prescribed a register of marks specifying the particulars which the several marks entered in the register are used as indicating, and the marking of any parcel with any mark entered in the register shall, for the purposes of this section, be treated as indicating that the particulars of the articles are those entered in the register in relation to the mark :

Provided that—

(a) on the sale of any parcel so marked the mark shall be added to the statutory statement, and

(b) where the statutory statement received by the seller on the sale to him of the parcel contains any such mark, and the parcel has not been on his premises, that mark shall be added by him to the statutory statement required to be given by him to a purchaser.

(3) If any parcel required under this section to be marked is not so marked, or if from the analysis of a sample of the parcel taken by an inspector in the prescribed manner on the premises on which the parcel is exposed for sale or on any premises on which the parcel after having been so marked may happen to be before being delivered to a purchaser or carrying agent, it appears that the particulars marked or indicated by a mark are false to the prejudice of the purchaser, or do not include any particulars which are required by this Act to be contained in the statutory statement, the person selling or having in his possession or disposition for the purpose of sale or consigning the parcel or exposing it for sale shall be guilty of an offence against this Act.

5. *Consignments ex-ship or quay.*—(1) In the case of an article delivered or consigned direct from a ship or quay to a purchaser, the provisions of this section shall apply in lieu of the provisions of the last preceding section.

(2) The seller of an article included in the first column of the First Schedule to this Act and so delivered or consigned shall as soon as practicable enter in a register kept by him in such form (if any) as may be prescribed the following particulars :—

(a) the date of delivery or consignment to the purchaser, the place of delivery to the purchaser or other destination, and the quantity delivered or consigned ;

- (b) any shipping or other mark on the article ;
- (c) the particulars which by this Act are required to be contained in the statutory statement.

(3) The seller of any such article shall be guilty of an offence against this Act—

- (a) if he fails to enter in his register any particular required by this section to be entered therein other than a particular required to be contained in the statutory statement ; or
- (b) if any particular entered therein, other than a particular required to be contained in the statutory statement, is false in any material particular ; or
- (c) if from the analysis of a sample of the article taken by an inspector in the prescribed manner on the quay or at the time of its delivery to the purchaser or during its transit to him it appears that any particular entered in the register, being a particular required to be contained in the statutory statement, is false to the prejudice of the purchaser, or that any particular required to be contained in the statutory statement is not entered in the register.

6. *Sales in small quantities.*—Where an article is sold for use as a fertiliser of the soil in small quantities from a parcel which purports to be labelled in the manner hereinbefore provided, and from an analysis of a sample thereof taken by an inspector in the prescribed manner on the premises on which the parcel is kept it appears that the particulars stated on the label are false to the prejudice of the purchaser, or do not include any particulars which are required by this Act to be contained in a statutory statement, the owner or seller shall be guilty of an offence against this Act.

7. *Penalties for failure to give and mis-statements in statutory statements.*—(1) If a person fails to give a statutory statement in such form (if any) as may be prescribed in any case where he is required by this Act so to do, he shall on summary conviction be liable, in the case of a first offence, to a fine not exceeding Rs. 50 and in case of a second or subsequent offence, to a fine not exceeding Rs. 100.

(2) If on the sale of an article included in the first column of the First Schedule to this Act a person gives a statutory statement in which the particulars stated therein differ :—

- (a) from the particulars marked or indicated by a mark placed on a parcel of the article in accordance with this Act ; or
- (b) in the case of an article delivered or consigned direct from a ship or quay to a purchaser, from the particulars entered in accordance with this Act in the seller's register, or
- (c) in the case of an article which has not been on the premises of the seller, from the particulars stated in the statutory statement given to the seller in respect of the article ;

he shall be guilty of an offence against this Act unless he proves that he took all responsible steps to avoid committing the offence and that he acted without intent to defraud.

(3) If a person fails to add to a statutory statement any mark which by virtue of this Act is required to be added thereto, he shall on summary conviction be liable, in the case of a first offence, to a fine not exceeding Rs. 50 and, in the case of a second or subsequent offence, to a fine not exceeding Rs. 100.

8. *Inspection of registers and statutory statements.*—(1) It shall be the duty of any person by whom a register under this Act is kept, or to whom a statutory statement relating to an article which has been sold by him but which has never been on his premises has been sent, to preserve the register or statement for such period (not exceeding four months) as may be prescribed, and on demand by an inspector at any time within that period to produce it for his inspection, and if the person keeping the register, or to whom such a statutory statement was sent, fails so to preserve it, he shall be liable on summary conviction to a fine not exceeding Rs. 200.

(2) Any person having in his possession or under his control any register kept under this Act or any statutory statement made under this Act shall on demand by an inspector produce it for his inspection and if he fails to do so shall be liable on summary conviction to a fine not exceeding Rs. 200.

(3) An inspector may at all reasonable times enter any premises where he has reasonable cause to believe that any such register or statutory statements is for the time being kept, and may take copies thereof.

9. *Relief from liability under the Merchandise Marks Acts in certain cases.*—Where in pursuance of the foregoing provisions of this Act a description has been applied to any article included in the first column of the First Schedule to this Act and such description is a trade description within the meaning of the Indian Merchandise Marks Act IV of 1889 no proceeding shall be taken under that Act on the ground that the description so applied is a false description.

ADMINISTRATIVE PROVISIONS.

Sampling and Analysis.

10. *Enforcement of the Act.*—(1) The Governor acting with the Ministers shall appoint an official agricultural analyst (in this Act referred to as the agricultural analyst) and such inspectors and official samplers as may be necessary and fix their jurisdiction.

Provided that every such inspector shall be a whole-time officer.

(2) A deputy agricultural analyst may also be appointed, who shall in the case of the illness, incapacity, or absence of the agricultural analyst, or pending the appointment of the agricultural analyst, have all the powers and duties of the agricultural analyst; and where the deputy acts, this Act shall apply as if he were the agricultural analyst.

(3) A person holding the office of official sampler shall not engage in farming or any business connected with the manufacture, sale or importation of articles used as fertilisers of the soil.

11. *Power of entry and sampling.*—(1) An inspector appointed under this Act may at all reasonable times enter any premises in which he has reasonable cause to believe that there is any article included in the first column of the First Schedule to this Act which has been prepared for sale or consignment, which is stored for use and not for sale or manufacture, and may take samples in the prescribed manner of any article on such premises which he has reasonable cause to believe to be such an article as aforesaid.

(2) An Inspector appointed under this Act may for the purposes of this Act take a sample otherwise than in the prescribed manner of any article which has been sold for use as a fertiliser of the soil or which he has reasonable cause to believe to be intended for sale as such ; but the name of the seller or purchaser or owner of the article of which a sample is so taken shall not be communicated to any person.

(3) Where a sample of a parcel packed ready for retail sale which is of fourteen pounds weight or less and is exposed for sale by retail is taken under this section, the retailer may require the inspector to purchase the parcel on behalf of the local authority or of the Government, as the case may be.

(4) In the exercise at any railway station or upon any railway premises of the powers conferred upon him by this Act an Inspector shall conform to such reasonable requirements of the railway company owning or using such station or premises as are necessary to prevent the working of the traffic thereat being obstructed or interfered with.

12. *Provisions as to analysis of samples.*—(1) Where a sample has been taken by an inspector or official sampler in the prescribed manner he shall divide it into three parts and cause each part to be marked, sealed and fastened up and he shall send two of the parts to the agricultural analyst together with a signed statement that the sample was taken in the prescribed manner, and the third part he shall deliver or send to the owner or seller as may be prescribed.

(2) Where a sample submitted to the agricultural analyst has been so divided into parts, the agricultural analyst shall analyse one of the parts of the sample sent to him and shall retain the other for such period as may be prescribed.

(3) If the person by or on whose behalf the sample of an article is taken and analysed, or the owner or seller of the article, objects to the certificate of the agricultural analyst, the person objecting thereto shall, on payment of such fee as may be fixed by the Local Government be entitled to have submitted to the Chemical Examiner to the Government of Madras the part of the sample retained by the agricultural analyst and to have that part analysed by him and to receive from him a certificate of the result of his analysis.

(4) Where a sample or part of a sample is under this section sent for analysis to the agricultural analyst or the Chemical Examiner to the Government of Madras there shall also be sent to him any statutory statement or warranty relating to the article sampled or a copy thereof, or a copy of the particulars marked on or indicated by a mark applied to the article.

(5) A certificate of analysis shall be signed by the agricultural analyst or the Chemical Examiner to the Government of Madras as the case may be ; but the analysis may be made by any person acting under the direction of the agricultural analyst or the Chemical Examiner to the Government of Madras.

(6) Where a sample taken in the prescribed manner has been analysed by the agricultural analyst, he shall furnish to the person who submitted the sample for analysis and, where that person is not the purchaser, also to the purchaser and in every case to the owner or seller of the article his certificate of analysis :

Provided that, if the agricultural analyst does not know the name and address of the owner or seller, he shall send his certificate intended for the owner or seller to the person who submitted the sample, who shall forward it to the owner or seller.

(7) Where the sample has not been taken in the prescribed manner, the agricultural analyst shall send the certificate to the person who submitted the sample to him.

13. *Tampering with samples.*—If any person fraudulently—

(a) tampers with any article so as to procure that any sample of it taken or submitted for analysis under this Act does not correctly represent the article ; or

(b) tampers or interferes with any sample taken or submitted for analysis under this Act ;

he shall be liable on summary conviction to a fine not exceeding Rs. 500 or to imprisonment for a term not exceeding six months.

14. *Obstruction of Inspectors.*—If the owner or person entrusted for the time being with the charge and custody of any article refuses to allow an Inspector to take a sample of the article on any premises on which he is authorised under this Act to take a sample, or if any person otherwise wilfully delays or obstructs any inspector in the execution of his duties under this Act, he shall be liable on summary conviction to a fine not exceeding Rs. 200 :

Provided that an Inspector seeking to exercise his powers under this Act shall, if so required, produce evidence of his appointment or authority.

15. *Prohibition against disclosures.*—If any Inspector discloses any information obtained by him in or in connection with the exercise of his powers under this Act, except to persons acting in the execution of this Act and so far as such information may be necessary for the execution thereof, he shall be liable on summary conviction to a fine not exceeding Rs. 500.

16. *Returns of results of analysis.*—The Director of Agriculture, Madras, shall as soon as practicable after the first day of January in each year, make a return to the Government of the results of the analysis of the samples forwarded to the agricultural analyst during the preceding twelve months in such form as may be prescribed, and the agricultural analyst shall furnish to the Director of Agriculture, Madras, such information as may be necessary for the purpose.

Legal Proceedings.

17. *Penalties for offence.*—Any person guilty of an offence against this Act for which no special penalty is provided by this Act shall on summary conviction be liable in the case of a first offence to a fine not exceeding Rs. 200 and in the case of a second or subsequent offence to a fine not exceeding Rs. 500.

18. *Restrictions on taking proceedings.*—(1) Proceedings for any offence against this Act to which the last foregoing section applies shall not be commenced without the consent of the Government and where the proceedings are in respect of causing or permitting any name, mark or particulars (except particulars which are not required to be contained in a statutory statement) to be false, or in respect of failure to include in the particulars marked or indicated by a mark or entered in a register or written on a label, any particulars which are required by this Act to be contained in the statutory statement, the consent of the Government shall not be given until the part of the sample retained by the agricultural analyst has been analysed and a certificate of analysis given by the Chemical Examiner to the Government of Madras.

(2) Where proceedings under this Act are taken against a person in respect of causing or permitting any name, mark, or particulars to be false, or for making a false entry in his register he shall not be liable to conviction if he proves—

(a) that having taken all reasonable precautions against committing an offence against this Act he had not at the time of committing the alleged offence reason to suspect the correctness of the mark or entry, or the presence of such ingredient as aforesaid, as the case may be; and

(b) where he obtained the article from some other person, that on demand by or on behalf of the prosecutor he gave all the information in his power with respect to the person from whom he obtained it and as to the statutory statement given to him, and as to any mark applied to the article when he obtained it.

(3) A prosecution in respect of causing or permitting any name, mark or particulars to be false shall not be instituted under this Act after the expiration of three months from the date on which a sample of the article was taken in the prescribed manner.

(4) In any such prosecutions as aforesaid the summons shall state the particulars of the offence alleged and also the name of the prosecutor, and shall not be made returnable in less time than fourteen days from the date on which it is served, and there shall also be served therewith a copy of any certificate of the agriculture analyst obtained on behalf of the prosecutor.

19. *General provisions as to legal proceedings.*—(1) Proceedings for an offence under this Act may, if the prosecutor so desires, be taken in the place where the person charged resides or carries on business.

(2) In any proceedings for an offence under this Act it shall be no defence to allege that a sample having been taken for analysis only there was no prejudice to the purchaser.

(3) A prosecution for an offence under this Act may, subject to the provisions of this Act as to the consent of the Government be instituted by the person aggrieved and in any case where a sample has been taken by an inspector on behalf of Government may be instituted.

20. *Evidence of certificate of analysis.*—(1) Where a sample, which has been taken in the prescribed manner by an inspector or official sampler, and has been divided into parts and marked, sealed and fastened up as hereinbefore mentioned, has been analysed, the agricultural analyst's certificate shall at the hearing of any civil or criminal proceedings with respect to the article sampled be sufficient evidence of the facts therein stated, unless the defendant or person charged requires that the person who made the analysis be called as a witness, or that the sample be further analysed by the Chemical Examiner to the Government of Madras.

(2) In any legal proceedings the production of a certificate by the Chemical Examiner to the Government of Madras shall be sufficient evidence of the facts stated therein unless either party to the proceedings requires that the person who made the analysis be called as a witness.

General.

21. *Rules.*—(1) The Government may make rules for prescribing anything which under this Act is required or authorised to be prescribed, and generally for carrying this Act into operation; and in particular such regulations may provide—

- (a) for varying any of the schedules to this Act;
- (b) for prescribing the manner in which articles required to be marked under this Act are to be marked and the nature of such marks;
- (c) for prescribing the limits of variation for the purposes of this Act;
- (d) for prescribing the manner in which samples are to be taken and dealt with in cases where under this Act they are taken in the prescribed manner;
- (e) as to the method in which analysis for determining the percentages of particular substances are to be made;
- (f) as to the qualifications to be possessed by agricultural analysts and deputy agricultural analysts and as to the form of certificates of analysis given by them;

and where any schedule is varied by rules so made, this Act shall have effect as if the schedule as so varied were substituted for the schedule contained in this Act.

(2) For the purpose of assisting and advising them with respect to the making of rules under this Act, the Government shall, after consultation with such parties as appear to them to represent the interests concerned, jointly appoint an advisory committee.

22. *Exemption for certain sales.*—This Act shall not apply to the sale of an article used as a fertiliser of the soil where the sale is in exercise of a statutory power to enforce a right or to satisfy a claim or lien, or where the sale is made by an official receiver or assignee or any other officer appointed by a court of competent jurisdiction to satisfy a writ of

execution, or warrant or decree of any court, or a distress for rent or warrant of distress.

23. *Meaning of certain expressions.*—Where for the purposes of this Act the expressions “percentage of soluble phosphates” and “percentage of insoluble phosphates”, are used in statements of equivalents, they shall be taken to mean respectively the percentage of tribasic phosphate of lines which has been and that which has not been rendered soluble in water.

24. *Interpretation.*—(1) In this Act, unless the context otherwise requires :—

The expression “purchaser” includes any person other than a carrying agent acting on behalf of a purchaser :

The expression “inspector” includes an inspector appointed by the Government :

The expression “Chemical Examiner to the Government of Madras” means the head of the department of the Chemical Examiner to the Government of Madras.

(2) An article consigned to a purchaser shall not for the purposes of this Act be deemed to be delivered to him until it arrives at the place to which it is consigned whether the consignment is by direction of the seller or the purchaser.

(3) Where an article is delivered to a purchaser in two or more consignments, this Act shall apply to each consignment as though it were a separate article.

(4) Where the method of analysis for determining the amount of any substance contained in an article is prescribed under this Act, any statement in any statutory statement or document which by virtue of this Act takes effect as a warranty and any mark on an article or entry in a register under this Act stating or indicating the amount of such substance shall be taken to be a statement of the amount of the substance as determined by analysis in accordance with the method so prescribed.

(5) Particulars as to the nature, substance, or quality of an article marked or indicated by a mark or entered in a register shall not for the purposes of this Act be deemed to be false to the prejudice of the purchaser if the mis-statement as respects any ingredient does not exceed the limits of variation (if any) prescribed under this Act in relation thereto.

SCHEDULES.

FIRST SCHEDULE.

ARTICLES TO WHICH ALL THE PROVISIONS OF THE ACT ARE APPLICABLE.

PART I.

Fertilisers.

<i>Article.</i>	<i>Particulars to be contained in Statutory Statement.</i>
Basic slag	Amount of phosphoric acid—total and that soluble in 2 per cent. citric acid. Percentage of the article that will pass through a sieve having one hundred meshes to the linear inch.

Article.	Particulars to be contained in Statutory Statement.	
Basic superphosphate	Amount of phosphoric acid—total and soluble in 2 per cent. citric acid.	
Bone meal, or other product (excluding dissolved or vitriolised bone) obtained by grinding or otherwise treating bone, used for fertilising purposes.	Amounts of nitrogen and phosphoric acid respectively and amount that which will pass through a prescribed sieve.	
Calcium cyanamide	Amount of nitrogen. Amount of dicyandiamide if in excess of 2 per cent.	
Compound fertilisers, that is to say, mixtures of any article or of two or more articles mentioned in this part of this Schedule or in Part I of the Second Schedule with any other such article or articles or with any other substance.	Amount of nitrogen, potash, soluble phosphoric acid and insoluble phosphoric acid respectively.	
Dissolved or vitriolised bone ..	Amount of nitrogen, soluble phosphoric acid and insoluble phosphoric acid respectively.	
Fish residues or other product obtained by drying and grinding or otherwise treating fish or fish waste, used for fertilising purposes.	Amounts of nitrogen and phosphoric acid respectively.	
Guano, including Peruvian and other raw guanos.	Amounts of nitrogen, phosphoric acid and potash respectively.	
Hoofs	Amount of nitrogen.	
Hoofs and horns	Amount of nitrogen.	
Horns	Amount of nitrogen.	
Meat and bone residues, or any product not specifically mentioned elsewhere in this Part of this Schedule obtained by drying and grinding or otherwise treating bone, flesh, flesh fibre (including whale meat) and other slaughterhouse residues, used for fertilising purposes.	Amounts of nitrogen and phosphoric acid respectively.	
Nitrate of lime	Amount of nitrogen.	
Nitrate of soda	Amount of nitrogen.	
Oil seed fertilisers, including castor meal, mowrah meal, rape meal, groundnut meal, pungan meal, coconut meal or any residue which is obtained by the removal of oil from seeds sold in the form of a meal.	Amount of nitrogen.	
Potassium salts used as fertilisers ..	Amount of potash.	
Raw phosphate or phosphate rock, ground or unground.	Amount of phosphoric acid. Amount that will pass through a prescribed sieve.	

<i>Article.</i>	<i>Particulars to be contained in Statutory Statement.</i>
Sulphate of ammonia .. ..	.. Amount of nitrogen and amount of free acid.
Sulphate of ammonia (neutral) ..	.. Amount of nitrogen.
Superphosphate .. ..	.. Amount of soluble phosphoric acid.
Calcium hydrate ; slaked lime ..	.. Amount of calcium hydrate and equivalent of calcium oxide.
Chalk, ground .. ..	.. Amount of calcium carbonate and equivalent of calcium oxide.
Dried blood for fertilising purposes ..	.. Amount of nitrogen.
Limestone, ground .. ..	.. Amount of calcium carbonate and equivalent of calcium oxide. Amount that will pass through a prescribed sieve.
Precipitated bone .. ..	.. Amount of phosphoric acid.
Quick lime, ground or otherwise ..	.. Amount of calcium oxide.

The provisions of this Schedule shall apply to any article described therein under whatever name it may be sold or offered for sale, and notwithstanding that it contains a substance not mentioned in this Part of this Schedule.

Amounts are to be stated as percentages of the weight of the article.

Nitrogen is to be stated in terms of nitrogen.

Phosphoric acid is to be stated in terms of phosphoric anhydride P_2O_5).

Calcium carbonate is to be stated in terms of calcium carbonate ($CaCO_3$).

Calcium hydrate is to be stated in terms of calcium hydrate [$Ca(HO_2)$].

Calcium oxide is to be stated in terms of calcium oxide (CaO).

Potash is to be stated in terms of Potassium oxide (K_2O).

Free acid is to be stated in terms of Sulphuric acid (H_2SO_4).

SECOND SCHEDULE.

DEFINITION IMPLIED ON THE SALE OF ARTICLES UNDER CERTAIN NAMES.

PART II.

Fertilisers.

<i>Name under which Article sold.</i>	<i>Implied Definition.</i>
Basic slag .. ..	.. A by-product, containing phosphorus, obtained in the manufacture of steel and to which no addition has been made at the time of leaving or after it has left the furnace.

<i>Name under which Article sold.</i>	<i>Implied Definition.</i>
Basic superphosphate	A non-acid phosphate produced by mixing lime with superphosphate of lime and to which no other matter has been added.
Bone meal	Commercially pure bone, raw or degreased, which has been ground or crushed.
Calcium cyanamide	Commercial calcium cyanamide.
Calcium hydrate ; slaked lime	Commercial hydrate of lime.
Castor meal	The residue obtained by the removal of oil from commercially pure castor seed, and which has been ground.
Chalk, ground	The product obtained by grinding cretaceous limestone, to which no other matter has been added.
Cocoonut meal	The residue which is obtained by the removal of oil from commercially pure cocoonut kernel.
Compound fertilisers	Mixtures of any article or of two or more articles mentioned in the First Schedule with any other such article or articles or with any other substance.
Dissolved or vitriolised bone	Commercially pure bone which has been treated with sulphuric acid.
Dried blood manure	Blood which has been dried, to which no other matter has been added.
Fish guano ; fish manure	A product obtained by drying and grinding or otherwise treating fish or fish waste, to which no other matter has been added.
Groundnut meal	The residue which is obtained by the removal of oil from commercially pure groundnut seed and which has been ground.
Hoofs	The product obtained by crushing or grinding hoof, to which no other matter has been added.
Hoofs and horns	A mixture of hoof and horn, crushed or ground, to which no other matter has been added.
Horns	The product obtained by crushing or grinding horn, to which no other matter has been added.
Limestone, ground	The product obtained by grinding sedimentary rock consisting largely of carbonate of lime, to which no other matter has been added.

<i>Name under which Article sold.</i>	<i>Implied Definition.</i>
Meat and bone manure ; meat meal ; carcase meal.	The product or drying and grinding or otherwise treating bone, flesh, flesh fibre (including whale meat) and other slaughter-house residues, to which no other matter has been added.
Mowrah meal	The residue which is obtained by the removal of oil from commercially pure mowrah seed.
Muriate of potash	Potassium chloride for fertilising purposes.
Nitrate of lime	Calcium nitrate for fertilising pur- poses.
Nitrate of soda	Sodium nitrate for fertilising pur- poses.
Precipitated bone	An insoluble calcium phosphate pre- pared by treating commercially pure bone with acid, and precipitation of phosphate from the solution.
Pungam meal	The residue which is obtained by the removal of oil from commercially pure pungam seed and which has been ground.
Quicklime, ground or otherwise ..	Commercial calcium oxide.
Rape meal	The residue which is obtained by the removal of oil from commercially pure rape seed, and which has been ground.
Raw guano	The excrement and remains of birds, containing both nitrogen and phos- phorus, prepared for use by screen- ing where necessary, but to which no addition has been made.
Raw phosphate or phosphate rock, ground or otherwise.	The substance obtained from mineral calcium phosphate deposits, to which no other matter has been added.
Steamed bone flour ; steamed bone meal.	Commercially pure bone from which nitrogen has been removed by steam.
Sulphate of ammonia	Ammonium sulphate for fertilising purposes.
Sulphate of ammonia (neutral) ..	Ammonium sulphate for fertilising purposes, containing not more than 0.025 per cent. of free acid in terms of sulphuric acid.
Sulphate of potash	Potassium sulphate for fertilising purposes.
Superphosphate	A mineral substance containing soluble phosphate of lime.

LETTER FROM DR. J. SEN, M.A., PH.D., PLANT BIOLOGICAL CHEMIST, PUSA (BIHAR), No. 5/II-P.B.C. OF 1930, DATED THE 3RD JANUARY 1931.

With reference to your letter No. 2439-Agri., dated 18th November 1930, I have the honour to state that I cannot furnish any direct evidence on the necessity for an All-India Fertilizers Act, except the instance of a dispute about the composition of a fertilizer between the Department of Agriculture in Madras and a firm of manure manufactures in connection with which a sample of manure was sent to our laboratory in 1925.

LETTER FROM MR. D. MILNE, B.Sc. (AGRI.), C.I.E., I.A.S., DIRECTOR OF AGRICULTURE, PUNJAB, No. 350, DATED THE 7TH JANUARY 1931.

With reference to your letter No. 2439-Agri., dated 18th November 1930, I have the honour to say that artificial manures are used to a very limited extent yet in the Punjab and these are generally in the hands of agents of reliable firms. By far the greatest portion of these manures consist of Nitrate of Soda and Sulphate of Ammonia.

No complaints of adulteration have come to me, but as few zamindars have probably had their artificial manures analysed it is possible to have a good deal of adulteration going on without detection.

A representative of an important firm of artificial manures has stated that in Madras a firm is preparing manures by mixing cane trash and other vegetable matter with sulphate of ammonia and if this is so, a Fertilizers Act is clearly desirable to ensure that cultivators are getting value for their money. When farmers are driven to greater intensities of copying, artificial manures will be used in far greater quantity, and it seems to me that it will be much easier to introduce the Act suggested above now, than it will be when many vested interests which will oppose it have been established. I therefore think that the practicability of introducing a Fertilizers Act in India should be explored as early as possible.

LETTER FROM M. CARBERY, Esq., D.S.O., M.C., M.A., B.Sc., AGRICULTURAL CHEMISTS, TO THE GOVERNMENT OF BENGAL, No. 3200-C/6, DATED THE 5TH JANUARY 1931.

With reference to attached letter No. 2439-Agri., dated 18th November 1930, from the Secretary, Imperial Council of Agricultural Research, I have the honour to state that on the whole we as a department are in favour of a Fertilizers Act to prevent adulteration. Both in the case of bone meal and castor cake a number of samples adulterated with sand have been received ; in one such, bone meal was found to contain as high as 26 per cent. sand.

In the interests of the cultivators therefore such an Act as above would seem very advisable.

I would therefore ask you to forward this to the Secretary, Imperial Research Council, if possible before 15th January 1931, as the view of the officers of the department, but not the considered decision of Government.

LETTER FROM DR. S. B. SINGH, M.Sc., Ph.D. (CANTAB.), ASSISTANT DEPUTY DIRECTOR OF AGRICULTURE, MEERUT, No. 1731, DATED THE 17TH MARCH 1931.

With reference to your letter No. 2439-Agri., dated 18th November 1930, I have the honour to inform you that I have not come across any cases of adulteration of artificial fertilizers. The consumers generally purchase it direct from the agents of different big and reliable firms under guarantee and there is very little chance of adulteration. I shall make further enquiries during my tour in the United Provinces commencing from 1st April 1931 in connection with the Manurial enquiry and if any case of adulteration comes to my notice, I shall communicate it to you. I think the cases of adulteration are not frequent enough to need any legislation at present.

LETTER FROM MR. P. H. CARPENTER, CHIEF SCIENTIFIC OFFICER, INDIAN TEA ASSOCIATION, ASSAM, No. 1191/31-C.S.O., DATED THE 29TH APRIL 1931.

Reference your letter No. 845-Agri., dated the 20th instant.

If the Fertilisers Act is meant for the purpose of restricting the importation of cheap manures into this country then I am definitely opposed to it, until such time as India can produce equally efficient manures at the same price. In regard to tea it is only possible to adopt the manuring schemes that are being used at the present time if manures can be bought cheaply and the only manures that are sufficiently cheaply obtainable are generally the imported ones. Indigenous fertilisers are too expensive to be economically employed. This is a general statement and might require modification in regard to specific manner from time to time but it is true as a general statement.

The tea crop is perhaps in a somewhat different situation to other agricultural crops as it is more highly organised. At the present time there are in use a certain set of rules accepted by Tea Companies and Manures suppliers. This serves as a basis of arbitration in case of dispute.

There are many difficulties in regard to the matter such as for instance when and how to draw the samples of manure. Manure that has been despatched from the sellers works and that has to undergo long transport can obviously not be sampled at its destination for the purpose of holding the supplier responsible for any deficiency. Until considerable details have been put forward and thoroughly examined in regard to the practicability of a Fertilisers Act in dealing with manures supplied to ryots I do not feel in a position to support the introduction of such an Act. It is certainly desirable that when any one buys some fertiliser that it should be up to a certain standard and that the price should be based on such a standard. It is however difficult to know how the ryot will have the opportunity of getting samples analysed and whether he would be in a position to pay for such analyses.

Note on the Promulgation of an All-India Fertilisers Act.

By

Rao Bahadur B. VISWA NATH,

Government Agricultural Chemist,

Agricultural Research Institute, Coimbatore.

The Agricultural Departments in India are educating the ryot on the necessity for and use of fertilisers. Consequently the use of manures and fertilisers is steadily expanding. With the demand for manures and fertilisers, their varieties, the number of dealers both big and small, are also on the increase. In the absence of any legislation to control the sale of manures and fertilisers, the ryot is often victimised by unscrupulous dealers.

I know instances of adulteration, wrong description and misleading names for fertilisers, which were brought to my notice either by educated landlords, or by departmental officers or by manure firms themselves in the course of their transactions with similar firm or firms. For instance, I had occasion to examine a so-called sample of "Basic Bone Superphosphate" which analysed like the genuine stuff but was not in reality "Basic Bone Superphosphate".

In another instance a mixture of bone-meal and ground rock phosphate was passed off as genuine bone-meal.

On another occasion consignments of fish guano were found to be not of real fish guano but a mixture made up of other substances and closely conforming to the analysis of fish guano.

Instances are not wanting in which manure mixtures which are either general or claimed to be specific in their action either falling below their guarantees or not containing the ingredients they are said to contain.

Certain manure sellers had the audacity to declare a certain manure to contain 70 per cent. of organic matter and high percentage of plant food constituents. On examination this substance contained no organic matter and did not come up to the guarantee in regard to other constituents.

Yet another instance in which the cultivator is victimised is the advertising of manures under fancy names with undeserving claims. A manure by name Electric manure was widely advertised sometime ago. The sellers made such extraordinary claims that would tempt even the most cautious buyer. I caught hold of a sample and on examination found it a fraud. The stuff contained finely powdered organic debris mixed probably with brewery waste and was innocent of plant food-constituents.

The dealers were mostly petty upstarts in fertiliser business, but the substances they dealt in were all manufactured in England, Australia, Germany and other countries outside India.

Again, manures and fertilisers are offered under such names as Radiophos, Hoofafas, Lennophos, and Niciphos while there are many specific mixtures for crops, such as Paddy mixture, Sugarcane mixture, Tobacco mixture. These are, in my opinion, misleading and puzzling even to one acquainted with fertilisers. The cultivator and even the officers of the

Agricultural Departments have no knowledge of their composition until sometime after they are introduced and in the meantime many buyers would have burnt their fingers in the transaction and view with suspicion even manures and fertilisers of good quality.

It appears to me that there is a case for legislation to control the sale of fertilisers.

To begin with, legislation may be on the model of the British Fertiliser Act.

The wholesale imitation of the British Fertiliser Act may not be suitable. While we can safely retain the sections dealing with penalties, specifications, methods of analysis and limits of error, considerable modification may be necessary in regard to the scope and extent of the Bill in India.

In India, imported manures are practically synonymous with artificial fertilisers. The case of indigenous manures like oil cakes, fish manure and bone meal require careful consideration.

It must be decided whether the Act should apply—

- (1) to all manures or limited to artificial manures,
- (2) to all dealers in manures or in substances having manurial value or only to dealers with certain specified business dimensions.

It is desirable to include all manures within the scope of the Act but in the case of manures like fish manure, oil cakes, etc., care should be taken to see that people like oil mongers and fishermen are excluded. This may be done by registering or licensing manufacturers of or dealers in fertilisers and to restrict the application of the Act only to such dealers or manufacturers. Then all substances sold as manures or fertilisers, whether indigenous or imported may be brought within the scope of the Act and a warranty of analysis insisted upon.

LETTER FROM DR. P. E. LANDER, M.A., D.Sc., I.A.S., AGRICULTURAL CHEMIST TO GOVERNMENT, PUNJAB, LYALLPUR, No. 552/36-147, DATED THE 4TH MAY 1931.

I have the honour to acknowledge your No. 845-Agri., dated 20th April 1931, and have read the paragraph in question.

I have recently started some work on bone meal and the difficulty I have experienced in getting bone meal of a satisfactory degree of fineness, and being able to obtain subsequent trials of identical grade is in my opinion definite evidence that for this particular manure definite specifications as to quality are required and a control exercised such as could only be done under a Fertilizers Act which lays down definite standards of analysis.

I am not in a position to offer detailed remarks on other manures.

Indian Chemical Industries is the main firm dealing with manures in India, and I understand that they do conform to certain standards in their supplies, although these are regulated by their business requirements and not by an Act.

In purchasing manures from other sources, no one has any guarantee of quality, and in my opinion all manures sold in India should be required

to conform to certain specifications as laid down by an All-India Fertilizers Act.

LETTER FROM RAO SAHIB B. P. VAGHOLKAR, L.A.G., DEPUTY DIRECTOR OF AGRICULTURE, S. C. D., POONA, AND RAO BAHADUR D. L. SAHASRABUDDHE, M.Sc., M.A.G., AGRICULTURAL CHEMIST TO GOVERNMENT OF BOMBAY, COLLEGE OF AGRICULTURE, POONA, No. 175/54 OF 1931, DATED THE 4TH MAY 1931.

With reference to your letter No. 845-Agri., dated 20th April 1931, we have the honour to state that we are of opinion that there is no necessity at present of an "All-India Fertilisers Act".

LETTER FROM MR. A. McKERRAL, M.A., B.Sc., I.A.S., DIRECTOR OF AGRICULTURE, BURMA, No. 3001/1-A-10, Pt. III, DATED THE 5TH MAY 1931.

With reference to the correspondence ending with your letter No. 850-Agri., dated the 20th April 1931, I have the honour to state that up to present time the consumption of fertilisers in this province has been very small and has been practically limited to the quantity used in experimental and demonstration work. Nevertheless, the experiments conducted by the Agricultural Department in Burma have clearly shown that if prices of agricultural produce had remained constant, there would have been a very considerable demand for fertilisers in the near future. Even at present prices there is evidence to show that fertilisers of certain kinds can be made to pay. It is also very likely that in the near future, there will be an adaptation of prices in general and prices of fertilisers will fall with prices of the agricultural produce.

2. I have no doubt in my own mind that a Fertilisers Act will be necessary in the near future and I consider that the present is the proper time to prepare a draft of this legislation. I recommend therefore that the matter be taken up by the expert officers of the Imperial Council of Agricultural Research. The Act should provide for inspection and sampling by officers of the Agricultural Department who should be notified as inspectors. The Agricultural Chemists should be notified as examiners. I think that the Act should be comparatively easy to enforce even with the existing staff of the Agricultural Department or with slight additions to the chemical side of the staff.

ANNEXURE II.

Proceedings of the second meeting of the Fertilizers Committee of the Imperial Council of Agricultural Research, held at New Delhi, on Wednesday, the 28th February 1934.

* * * * *

3. Question of the need for an All-India Fertilisers Act (Subject No. 5 of the Agenda.).

Mr. Burt introduced the subject. In doing so he explained that the Fertilisers Committee had considered the question at its first meeting held in June 1930 and was provisionally of the opinion that an All-India Act was generally desirable, but recommended that before the next meeting of

the Committee when the question would be further considered, the representatives of the various provinces should examine the necessity for an All-India Act. The members of the Committee were accordingly requested to examine the question in detail and to forward any definite evidence which they might have of the need for an All-India Fertilisers Act. Mr. Burt went on to say that from the replies received from the members of the Committee it appeared that the case for a Fertilisers Act was no stronger now than when the Royal Commission on Agriculture in India reported. He then referred to the view of the Royal Commission on Agriculture that the practice of adulteration did not at present exist on such a scale as to necessitate an All-India Act. At the same time he pointed out that premature legislation was fraught with some danger as the sale of manures was insufficiently organised at present and there were not enough retailers. In these circumstances if the liabilities of a shopkeeper who sold manures, were increased by the passing of a Fertiliser Act, this might have the effect of discouraging him from stocking and retailing such manures as oil cakes, ground bones, etc., at village centres. On the whole, therefore, the position appeared to be that there was no strong public opinion in favour of, or any urgent need for an All-India Fertilisers Act. What seemed to be required at the present stage was to teach those ryots who bought artificial manures to demand a certificate of composition of the manure. The Chairman enquired as to what had happened to the Madras Fertilisers Bill which it was proposed to introduce sometime ago and he was informed that it had been dropped. Mr. Ramdas Pantulu said that personally he was still in favour of an Act with a view to have some measure of control over dishonest dealers in manures. Mr. Stewart said that from the point of view of the Punjab he did not consider the proposed legislation desirable because the sale of artificial manures in that province was small. Dr. Singh also said that as far as he knew there was no adulteration in the United Provinces and that legislation of the kind suggested was not required. Rao Bahadur Viswanath said that while he did not press for an All-India Fertilisers Act he thought it desirable that some measures should be provided for punishing deliberate adulteration of fertilisers. In his opinion, it would meet the needs of the case if a simple measure were enacted making it compulsory to give the analysis of a particular manure on the outside of the container. Rao Bahadur Ananda Rao said that though there were not many cases of adulteration it would be useful to require the analysis to be put on the container. Rao Bahadur Sahasrabudhe thought that since 1930 when the Committee first made its provisional recommendation matters had improved to a certain extent. He would not favour any action beyond requiring analysis being shown on the outside of the containers. Mr. Carpenter was of the view that there were advantages in having an Act but he anticipated very great difficulties in administering it from the point of view of cultivators. For instance, if were made compulsory to state the composition of the fertilisers on the containers how would it be possible for a cultivator purchasing that fertiliser to be sure that the article was really what it claimed to be. In this connection he referred to clause 3 of the Madras Fertilisers Bill to which reference has been made above, and said that it would be impossible for a cultivator to have a sample of the article analysed by an official analyst and take the further action necessary after receiving a certificate

of the results of his analysis. The Chairman thought that Agricultural Departments might take up this work but then it would increase their work very considerably. On the whole, however, Mr. Carpenter was of the opinion that the suggestion regarding the showing of the composition of the fertilisers was good. Rao Bahadur Sahasrabudde stated that the whole thing would depend on how samples were taken and pointed out that it is far from easy to take samples which are fairly representative of the whole bulk. Rao Bahadur Viswanath said that there would be no great difficulty in regard to having the samples analysed and said that the United Planters' Association of South India would be able to make valuable suggestions. He favoured a simple law making it compulsory to exhibit composition on the containers with provision for light punishment for non-observance of rules. Mr. Ramadas Pantulu said that such a law would be welcomed in Madras. Mr. Burt would favour the law if it were feasible but he pointed out that there were difficulties in regard to the labelling of organic manures. The Chairman said that the important point to consider was whether such an Act would be acceptable to public opinion in India as a whole. It was pointed out that the Act might be an enabling one within the power of each Provincial Government to introduce if and when it was considered necessary. In the end it was agreed that the matter should be put before the next meeting of the Advisory Board with the members of the Committee expressed at the meeting. Meanwhile the members from each province should go into the practicability of a law insisting on labels stating the composition of the manure and the desirability of prohibiting ready made mixtures of un-stated composition. It was decided that members should send their replies to the Secretariat of the Council which would then place them before the Advisory Board at its next meeting. It was also considered that the opinions of fertilisers manufacturers, should, as far as possible, be obtained and laid before the Board.

ANNEXURE III.

COPY OF LETTER FROM DIRECTOR OF AGRICULTURE, BIHAR AND ORISSA, No. 387-A.T. [I-78-33]24-34, DATED RANCHI, THE 6TH JULY 1934.

With reference to your letter No. F. 1/34-Agri., dated the 30th June, 1934, I have the honour to say that I do not think the proposed legislation is feasible. In any case it would be of little help to the general cultivator in this province owing to illiteracy and very few if any would care to take the trouble of having a particular manure of doubtful composition analysed and then a recourse to law courts. There would also be considerable difficulties in labelling organic manures. This would be particularly impractical in the case of oil cakes produced by village oilmen and marketed through local dealers.

COPY OF LETTER FROM AGRICULTURAL CHEMIST TO GOVERNMENT, AGRICULTURAL COLLEGE, POONA, No. I. 75-524 OF 1934, DATED POONA, 7TH JULY 1934.

With reference to your memorandum No. F. 1/34-Agri., dated 30th June 1934, I have the honour to say as follows :—

There is at present no necessity of an all-India Fertilisers' Act but if any Act is passed at all it should be to compel dealers in fertilisers and

fertiliser mixtures to give clearly on the container the composition of the fertiliser and also mention the ingredients of the mixtures. I have considered the whole question very carefully and have consulted others and as a result have expressed the opinion given above.

COPY OF MEMORANDUM FROM DIRECTOR OF AGRICULTURE, C. P., No. 2807,
DATED THE 11TH JULY 1934.

I enclose herewith a copy of the opinion recorded by the Agricultural Chemist to Government, Central Provinces, Nagpur. I agree to the suggestions made by him.

2. The passing of an Act of the nature in any Province will have the effect of making it apply in all Provinces, as it is unlikely that big firms like Imperial Chemical Industries would go to the trouble of fixing labels for say one Province only where the Act applies, when it would be as easy to supply all their consignments with the necessary information.

COPY OF U.-O. FROM THE AGRICULTURAL CHEMIST, C. P., NAGPUR, TO THE
DIRECTOR OF AGRICULTURE, C. P., NAGPUR, No. 16, DATED THE 6TH
JULY 1934.

In the Central Provinces the sale of fertilisers and concentrated organic manures cannot be said to be in any way what one should desire. Generally speaking, fertilisers and manures are sold by accredited agents of firms of established reputation. Occasionally one however meets with instances of quacks dealing with some special fertilisers which they advocate for particular crops. One such case was met with last year. A sample of fertiliser mixture for cotton advertised by Deshmukh and Co. of Warud, District Amraoti, was forwarded to me by the Deputy Director of Agriculture, Western Circle, Amraoti, for analysis. It was surprising to see that the so-called fertiliser contained principally about 16 per cent. moisture, 51 per cent. sand, 7 per cent. sodium chloride, 15 per cent. acid soluble material and practically no traces of the fertilising constituents *viz.*, Nitrogen, phosphoric acid or potash in any form whatsoever.

It however seems to me that such cases of deliberate cheating are but rare and for which, for the present, any drastic legislation would appear unnecessary in so far as our Province is concerned. I am of the opinion that instead of an all India legislation, each Provincial Government may if found necessary introduce some simple form of legislation which would make it compulsory for dealers to show the composition of the various fertilisers and manures they deal in, and which would provide for the imposition of small fines on those who fail to comply with the law. With regard to the question of introducing such legislative measure in our Province, I would suggest that opinions of the Deputy Directors of Agriculture may be invited and it may be ascertained from them if they come across frequently with cases of deliberate cheating in the sale of fertilisers and manures.

COPY OF A LETTER FROM MESSRS THE CAWNPORE CHEMICAL WORKS, LTD.,
ANWARGANJ, CAWNPORE, DATED THE 13TH JULY 1934.

We are in receipt of your letter No. F. 1/34-Agri., dated the 30th June 1934, together with the proceedings of the 2nd meeting of the Fertilizers committee.

We are in full agreement with the objects of the Act.

COPY OF A LETTER FROM DEPUTY DIRECTOR OF AGRICULTURE, NORTH-EASTERN
CIRCLE, GORAKHPUR, No. 331/VII-46-A. (32), DATED THE 14TH JULY
1934.

With reference to your Memorandum No. F. 1/34-Agri., dated 30th June 1934, I have the honour to say that at present I am in favour of labels of composition only on costly artificial manures and mixtures. The prices of Oil cakes and bone manures are sure to rise considerably if a costly container is insisted on ; only a certificate indicating the manurial composition would serve the purpose in the case of such manures.

So far no cases of adulteration have come to my notice and a very simple legislation, if any, appears necessary.

COPY OF A LETTER FROM THE GOVERNMENT AGRICULTURAL CHEMIST, LAWLEY
ROAD, P. O., COIMBATORE, No. 479-GL/34, DATED THE 17TH JULY 1934.

*Reference :—*Your memorandum No. F. 1/34-Agri., dated Simla, the 30th June 1934.

With reference to the above, I have the honour to offer the following remarks :—

In discussing the desirability of enacting a simple law, in place of the full Fertiliser Act, it should be considered whether the Act should apply to all manures and to all dealers. There will be no difficulty with established and reputed manure firms. It is from the fraudulent practices of petty intermediate dealers that the ryot requires legal protection. There are the classes of people like fishermen and oil-mongers and products like fish manures and oil cakes. If these are to come within the scope of the law, the machinery for the working of the law will have to be very large and even then, there is the likelihood of considerable harm and mischief in the enforcement of the law. It will, therefore, be necessary, to exclude the classes of people mentioned above. It seems to me that the best plan would be to define a dealer in fertilisers and to make licensing or registration compulsory for carrying on business in the manufacture and sale of fertilisers. Then, all substances sold as fertilisers or manures whether indigenous or imported, may be brought within the scope of the contemplated law.

I am of the opinion that the sale of such manure mixtures as ' Paddy mixture ', ' Potato mixture ', ' Wheat mixture ', ' Sugarcane mixture ' should not be countenanced. The ryot has to pay in addition to nitrogen, phosphoric acid and potash, for the inert and even objectionable filler material such as sand, saw dust, leaf powder, ashes, and a host of other materials. It is not fair that the ignorant ryot should be asked to pay for this. It is one thing to make up mixed manures to order and supply and

another thing to sell ready made specific mixtures of unknown composition for particular crops. So far as I am aware, the sale of such ready made mixtures, is not in vogue in other countries and I am convinced that it is neither necessary nor desirable in this country. I would, therefore, welcome any action which does away with the sale of ready made mixtures.

An alternative measure calculated to regulate the sale of such mixtures is, that in addition to the usual guaranteed analysis stating the percentages of Nitrogen, Phosphoric acid and Potash, the names of the ingredients that make up the mixture be given. This is not an extravagant or unreasonable demand, if it is remembered that in the case of patent medicines, the manufacturer is legally bound to disclose not only the names but also the quantities of the several ingredients contained in it.

COPY OF A LETTER FROM THE DIRECTOR OF AGRICULTURE, BURMA, RANGOON,
No. 539-C.1-A., DATED THE 19TH JULY 1934.

With reference to your memorandum No. F. 1/34-Agri. of the 30th June 1934, I have the honour to state that I am in agreement with the proposal that there should be a law insisting on labels stating the composition of the manure provided always that it is understood that the law would not refer to Farm Yard or other organic manures in which case it would be impossible for sellers to comply with the requirements of the Act. The law should be limited to cover what are usually known as artificial manures or fertilisers produced in factories. I consider also that it is desirable to prohibit the sale of ready made mixtures of unstated composition.

COPY OF A LETTER FROM THE OFFICIATING DIRECTOR OF AGRICULTURE, PUNJAB,
No. 445/92-330-II., DATED THE 26TH JULY 1934.

In reply to your memorandum No. F. 1/34-Agri., dated the 30th June 1934, I have the honour to say that the necessity of an All-India Fertilizers Act seems desirable but a closer examination of the case reveals many difficulties which might render such an Act difficult to enforce and compliance with the terms of which might in many cases be impracticable. So far as the Punjab is concerned it seems, therefore, premature to consider the proposed legislation as the sale and application of artificial manures in this province is very limited so far. It would, however, be an advantage if the firms, which deal in these fertilizers, are required to put a sheet of analysis of the manure on each bag.

A copy of Dr. Lander's opinion—Dr. Lander is a member of the Fertilizer's Committee—is enclosed. I agree with the observations made by him.

COPY OF A LETTER FROM THE AGRICULTURAL CHEMIST TO GOVERNMENT,
PUNJAB, LYALLPUR, TO THE DIRECTOR OF AGRICULTURE, PUNJAB,
No. 1141, DATED THE 21ST JULY 1934.

I have the honour to reply to letter No. F. 1/34-Agri., dated 30th June 1934, from the Secretary, Imperial Council of Agricultural Research, on the subject of an All-India Fertilizers Act with objects as stated.

On the fact of it such an Act sounds highly desirable, but a closer examination reveals many difficulties which might render such an Act difficult to enforce, and compliance with the terms of which might in many cases be impracticable.

In the first place I may mention that purchases of artificial manures, presumably the only ones to which such an Act would be practically applicable, are for economic reasons largely outside the range of the vast majority of the cultivators, who rely largely on local organic manures.

We have, therefore, to consider the following three aspects of the situation as regards :

- (a) Imported artificials sold chiefly by Imperial Chemical Industries or kindred firms.
- (b) Artificials manufactured in the country such as bone meal.
- (c) Other manures such as oil seed cakes, etc.

(a) Under present conditions a customer purchasing direct from, say Imperial Chemical Industries can get a definition of analytical content and hence know the composition of the material he is buying.

There is nothing at present, however, to prevent retail shop keepers adulterating such purchases, and reselling in containers other than those in which the manures were supplied by Imperial Chemical Industries.

An Act such as that envisaged, might enable all products sold by wholesale firms such as Imperial Chemical Industries, to define their fertilizers in terms of analytical content, and might also make it obligatory on retailers to sell such articles in their original containers so as to obviate adulteration in the retail stages.

One point suggests itself, however, *viz.*, that an analytical definition would mean nothing to an illiterate cultivator, but under such an Act he would be assured that adulteration had not taken place. Perhaps some simple formula could be worked out for commercial purposes showing the amounts of the fertilizer in a given weight of the artificial sold in terms of a similar factor for Farm Yard Manure. For example a commercial sample of superphosphate would show the phosphate content and state that it contains 'x' times the amount found in a similar weight of average Farm Yard Manure.

(b) *Indigenous Artificials.*—I consider bone meal here, and an Act might be useful in demanding a specification of grade as related to the degrees of fineness, and phosphate content. The enforcement of the Act might be difficult unless the trade were put on a properly organised basis.

For example bone meal should be labelled in grades A, B, and C, according to specified degrees of fineness, steamed or unsteamed, etc.

(c) I do not think that much can be done here other than to state the nature of the manure. Analytical definition would be impracticable unless it were expressed in general and not absolute terms.

COPY OF A LETTER FROM DIRECTOR OF AGRICULTURE, TRIPLICANE, MADRAS,
D. DIS. No. D. 1-975-34, DATED THE 24TH JULY 1934.

Reference :—Your Memorandum No. F. 1/34-Agri., dated 30th June 1934.

The analysis of manures consisting wholly or partly of chemical manures may be required to be stencilled on bags, the per cent. amounts of N , $Po_2 O_5$, and K_2O also the amount of organic material, if any, being stated. Prescribed Agricultural Officers should have power to inspect manures and send samples for analysis when doubts arise as to the composition of any compound fertilizer. To such an end legislation may be necessary and the Deputy Directors are generally agreeable to such control. The manure firms consulted differ and I enclose for your information copies of their letters.

COPY OF LETTER FROM THE IMPERIAL CHEMICAL INDUSTRIES (INDIA), LTD.,
MADRAS, TO THE DIRECTOR OF AGRICULTURE, MADRAS, DATED THE 5TH JULY 1934.

We thank you for your letter R.O.C.D.-1-975-34, dated the 3rd instant and hasten to assure you that we would welcome legislation having for its object the prohibition of ready-made mixtures of unstated composition and further a law insisting on the guaranteed analysis being stencilled on the outside container. Such a measure will be a very valuable contribution towards protecting the agriculturists from being exploited by unscrupulous persons.

COPY OF LETTER FROM MESSRS. T. STANES & Co., COIMBATORE, TO THE
DIRECTOR OF AGRICULTURE, MADRAS, DATED THE 11TH JULY 1934.

With reference to your letter R.O.C.D.-1-975-34 of the 3rd instant, we have the honour to inform you that we are not prepared to support any measure which insists that labels should be placed on each bag of manure stating the composition, as it is not in our interests to let our competitors know the exact composition of our fertilisers for the various crops.

If, however, a law similar to that now in use in England, namely, the Fertilisers and Feeding Stuffs Act, whereby the analysis of the contents of the bag is shown on a label, is proposed, we are prepared to offer our full support, as we consider that this would be a protection to the ryot from fraud which latter is certainly practised by some of the small fixing concerns. Further more, it will offer a protection to *bonafide* manure firms, who have made a practice of supplying satisfactory manure for all crops in the past.

It would be necessary to insist that the final seller of the manure would be responsible for the analysis of the manure, for, if such a clause were not included, it is quite possible that Agents or Sub-Agents of fertiliser firms might deliberately adulterate a bag of manure before selling it to their constituents.

We consider that the analysis should include the total Nitrogen, total Phos. Acid and total Potash. It may also be advisable to show in what form Phos. Acid is present, namely water soluble, citric soluble or in-

COPY OF LETTER FROM THE PRESIDENCY MANURE WORKS, LTD., MADRAS, TO THE DIRECTOR OF AGRICULTURE, MADRAS, DATED THE 10TH JULY 1934.

Your letter R.O.C.D. 1-975-34.

In reply to the above letter asking for our remarks on the proposal that a law should be passed insisting on labels being attached to manures stating the composition of the manure, we have the honour to point out that such a practice has never been in force in the British Isles and we see no reason for its institution in this country.

The sale of proprietary mixtures is a common practice, and the promulgation of a law such as that indicated would react unfairly against the larger firms in this country who have spent a considerable amount of money on pioneer propaganda work. Should a buyer wish to protect his interests he can always arrange to have any manures he has purchased tested by means of analysis and, in our opinion, this protection is all that is necessary.

COPY OF LETTER FROM THE INDIAN AGRICULTURE DEVELOPMENT AND MANURE ORGANISATION, COCANADA, No. 041187 OF 34, DATED THE 13TH JULY 1934.

With reference to your circular letter R.O.C.D. 1-975-34, dated the 3rd instant, we have the honour to inform you that in our opinion it is highly desirable to legally insist on labels stating the guaranteed percentage contents of Nitrogen, phosphoric acid and potash on all bags of manures and mixtures marketed by various firms.

This will enable the ryots to buy mixtures and manures containing the required amount of manurial ingredients for their crops and soils.

Besides, such a system would disallow any fraudulent practices by firms dealing in manures thereby safeguarding the interests of the poor agriculturist.

COPY OF A LETTER FROM THE AGRICULTURAL CHEMIST, BURMA, Mandalay, No. 2744|1-A.-19-A.C., DATED THE 21ST JULY 1934.

With reference to your memorandum No. F. 1|34-Agri. of the 30th June 1934, I have the honour to say that I am in favour of the suggestion of a law insisting on labels stating the composition of manures offered for sale provided that purely organic manures are excluded from the operation of the Act.

As regards ready made mixtures these should either be prohibited or made subject to the conditions of the Act.

COPY OF LETTER FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO THE PRESIDENCY MANURE WORKS, LTD., MADRAS, No. F. 1|34|A., DATED THE 6TH AUGUST 1934.

Please refer to your letter of the 10th July 1934 to the Director of Agriculture, Madras, dealing with the proposal that a Fertilizers Act should be passed in India which would require *inter alia* that all artificial

manures and all mixture manures should be labelled and the label should state the composition of the manure.

In your reply you object to the disclosure of the composition of proprietary mixtures and state that this is not the practice in Great Britain. It appears however that you would have no objection to legislation on the same lines as is now in force in England whereby the analysis of the contents of the bag is shown on a label. Such a label might state the percentage of nitrogen, the percentage of phosphoric acid, the percentage of potash, the percentage of soluble or available phosphate and fineness of grinding in the case of such manures as mineral phosphates. Would you kindly state your opinion on this point?

COPY OF LETTER FROM THE AGRICULTURAL CHEMIST TO THE GOVERNMENT OF BENGAL, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 50-R./5, DATED THE 6TH AUGUST 1934.

With reference to your Memorandum No. F.1/34-Agri., dated the 30th July 1934, I have the honour to inform you that one or two Firms have not yet replied to my letter. The Firms who have replied upto state, generally the following :—

- (i) In case of the sale of single Fertilisers the percentages are usually prominently branded on the bags containing them.
- (ii) That in the case of mixtures for Tea, Coffee and Rubber Estates, these are prepared according to the specifications supplied by the estates themselves.
- (iii) Where Firms have supplied mixtures, these have been arrived at by actual experimental and long experience.

Regarding No. I & II it would appear that no further legislation is necessary. As regards No. III the Firms are of opinions after long experience with the Indian cultivator that the latter is unlikely to change his usual practice of satisfying himself 1st by trial that some benefit will accrue. Thus superior mixtures have little chance of making much sale and so far it is reported have disappeared at the end of their 1st season.

As regards bone meal this office has had experience of several cases of adulteration in the past but have come across no recent cases. In the case of oil-cake our experience has been not so much adulteration as presence of excess oil due to bad crushing.

It would generally appear that there is at present no pressing need for legislation and this Department should continue their policy of strongly recommending the purchase of such manures and fertilisers as are advised for particular tracts and crops, from reliable Firms.

COPY OF LETTER FROM THE IMPERIAL CHEMICAL INDUSTRIES (INDIA), LTD., CALCUTTA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. J./5, DATED THE 10TH AUGUST 1934.

In reply to your letter of the 6th instant, our view is that legislation of the kind proposed is not yet necessary.

As far as our particular business is concerned, the only fertilizers which we sell in India are *Sulphate of Ammonia* and "*Nicifos*", with smaller quantities of Superphosphate and Potash. All these are sold on analyses, and in the case of Sulphate of Ammonia and "*Nicifos*", the percentages of Nitrogen and P_2O_5 are prominently branded on the bags.

As to ready made fertilizer mixtures of unstated composition, the total quantity of these offered for sale in India is comparatively small. We do not market them at all, but highly reputable firms such as Atlas Fertilizers, Ltd., Ewing & Co., Parry & Co., Peirs Leslie & Co., and Stanes & Co., do sell a certain quantity of such mixtures for specific crops such as potatoes, tobacco, chillies, etc. Their recipes have been arrived at by careful experiment, and only long experience has led to their mixtures being perfected for particular areas; and they are naturally unwilling to publish the composition of their special mixtures for the benefit of competitors. We think their attitude in this matter should receive the fullest consideration.

For Tea, Coffee, and Rubber Estates, mixtures are generally prepared according to the specifications supplied by the Estates themselves, and this type of business is conducted in accordance with the rules laid down by the Indian Tea Association controlling the sale of fertilizers. These rules have worked successfully for many years, and although we do not enter into this business directly, there appears to be no necessity for interfering with the system in operation at the present time.

Occasionally during the past five or six years, comparatively worthless mixtures have been offered to cultivators in India, chiefly in Bombay and Madras Presidencies, but in no cases have appreciable sales been made. The cultivator in India is extremely conservative as to the kind of fertilizer he purchases, and while he now uses quite large quantities of Sulphate of Ammonia, "*Nicifos*", and, to a lesser extent, Superphosphate and made-up mixtures, he will not buy any quantity of an unknown fertilizer without trying it on a small scale to begin with. The result of this is that all the superious mixtures placed upon the market so far have disappeared at the end of their first season after negligible sales amounting to no more than a few tons.

We have come across no instances of adulteration of Sulphate of Ammonia or Ammonium Phosphate fertilizers in India, although we have had instances of our own "*Crescent*" Brand Sulphate of Ammonia bags used to pack Sulphate of Ammonia of different origin, the substituted material however proving on test to comply with the 20.6 per cent. Nitrogen guarantee which we ourselves always give; the suggested legislation would not therefore have applied.

To answer your specific questions therefore we consider:—

1. That there is no need for such legislation at the present time. Almost the whole of the ryot's purchases consist of straight Sulphate of Ammonia or Ammonium Phosphate fertilizers. Since these are now very cheap and of excellent quality, the incentive to adulteration is not great, and inferior mixtures of unstated composition have found it so far impossible to establish themselves. Should any tendency to adulterate

the well known Sulphate of Ammonia and Ammonium Phosphate fertilizers develop, or should there be any increase in the production of worthless mixtures, we agree that it would be advisable to introduce legislation to protect the cultivator.

2. If it is decided that packages of mixed fertilizers should be labelled we are strongly of opinion that only the nitrogen, phosphoric acid, etc., content should be required to be shown and not particulars of the ingredients.

3. We should have no objection to your final suggestion that packages of such manures as oil-cake, etc., should be labelled with the analysis, but we do not think the fineness of grinding need be stated. This can be seen by the buyer for himself.

We trust that we have fully complied with your request but shall be very happy to be of any further assistance if you will kindly address us again.

COPY OF LETTER FROM THE MANAGER, ATLAS FERTILISERS LIMITED, CALCUTTA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, NO. F./G., DATED THE 10TH AUGUST 1934.

Fertilisers.

We are in receipt of your letter No. F.1/34/A. of the 6th instant, one copy of which was addressed to this office, and a further one to our Works at Kidderpore, for which we thank you.

In reply we would inform you that we have already been addressed by the Agricultural Chemist to the Government of Bengal in regard to the question of an All-India Fertilisers Act. Your letter under acknowledgment covers the same subject, and we accordingly now enclose for your information a copy of our reply to Government.

You will note from the copy of our letter our remarks in regard to the various points raised, and we have nothing further to add to the views then expressed.

We should be much obliged if you would advise us as to the outcome of the deliberations of the Advisory Board of the Council on this question after its next meeting early next month, for the matter is, of course, of considerable interest to us.

COPY OF LETTER FROM THE MANAGER, ATLAS FERTILISERS LIMITED, (SHAW WALLACE & Co.), TO THE AGRICULTURAL CHEMIST TO THE GOVERNMENT OF BENGAL, DATED THE 28TH JULY 1934.

Fertilisers.

We are in receipt of your letter No. 1863-66-R./5 of the 11th instant, in regard to the question of the necessity for an All-India Fertilisers Act, for which we thank you.

In reply we would explain that our business in Fertilisers in India has two distinct sides. On the one side there is our Estate business, *i.e.*, consisting of sales of fertilisers to Tea, Coffee, Tobacco, Rubber Estates, etc., either European or Indian owned and managed. The bulk of this business consists of mixtures composed of organic or inorganic materials, or a combination of both; the basis of sale for these mixtures is on a

guaranteed analysis, and in so far as Tea Estates in N. E. India are concerned, the business is conducted in accordance with the rules controlling the sale of fertilisers, as laid down by the Indian Tea Association.

These rules have been in force now for a number of years, and in our opinion have worked entirely satisfactorily ; in these circumstances we do not consider that for the Estate business any further legislation is called for.

The other side of our business consists of a distributing organization for the sale of fertilisers to cultivators through the medium of a system of Depots, the majority of which are situated in S. India. From these Depots we sell a variety of fertilisers, both mixed and unmixed, in accordance with local demand.

In so far as the unmixed fertilisers are concerned, we sell well-known materials such as Sulphate of Ammonia and Nicifos. The analyses of these fertilisers are widely advertised in English papers, and the information is made known to the cultivators through extensive propaganda, i.e., both verbally and by means of vernacular leaflets, posters, etc., and in addition the bags on sale at Depots are boldly branded both with the name and analysis of the contents.

As regards the mixed fertilisers, these consist of mixtures made up at our various works in accordance with certain formulæ designed for the manuring of specific crops. The formulæ have been devised after careful consideration and investigation by our Scientific Officers, and are amended from time to time to suit local conditions. Our aim is only to supply mixtures which will, if used in accordance with our recommendations, ensure cultivators securing satisfactory results, and the turn-over is consequently largely dependent on the measure of success obtained by their use.

These formulæ we regard as trade secrets, and it is only natural, therefore, that we should be averse to having to disclose to our competitors the composition of these mixtures.

As regards any declaration as to analysis, while we quite appreciate the desirability of creating, if possible, some protection for the cultivators from buying goods of unknown quality, we consider that any declaration of the analysis of our mixture might tend to help our competitors to market mixtures of inferior quality in imitation of ours.

A further point in connection with the Depot business is that of adulteration. In our experience in this business over a number of years, we have not come across any cases of adulteration due probably to the fact that Depot Agents have been keen to build up the business by selling the right goods, and also to the low selling prices of the various materials. However, the risk of adulteration is always present, and even if legislation stipulated the declaration of the composition of the mixture, it would nevertheless we think be difficult to make certain that the buyer was obtaining the right article. In our opinion the real test is results, and we consider that the sale of adulterated goods would always eventually kill itself.

We shall be glad if you will treat the views expressed, and the information given in this letter as private.

COPY OF LETTER FROM THE PRINCIPAL AGRICULTURAL OFFICER, SUGARCANE RESEARCH SCHEME, PADEGAON, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. F.M.1732 OF 1934, DATED THE 14TH AUGUST 1934.

SUBJECT :—*Necessity for an All-India Fertilisers Act.*

With reference to your No. F.1|34|Agri., dated 30th June 1934 and subsequent reminder, I have the honour to inform you that I am not in favour of Fertilisers Act but I think it is essential that the companies dealing with fertilisers should give analysis of a particular manure on the containers.

COPY OF LETTER FROM THE PRESIDENCY MANURE WORKS, LTD., MADRAS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEACH, SIMLA, DATED THE 14TH AUGUST 1934.

In reply to your letter of the 6th we consider that any declaration of the analysis of our mixtures would assist our competitors in marketing similar mixtures. We do not suppose that reputable firms would make use of such information, and so enable them to imitate our proprietary mixtures, although this is conceivable, but it is certainly probable that small mixers would take advantage of the information you suggest should be afforded, in order to market inferior mixtures, which would be sold as a substitute for our own. The ingredients of our Proprietary mixtures have been arrived at only after long years of experience and investigation by our scientific staff. We consider, therefore, that the exact components of such mixtures must rightly be regarded as trade secrets, and for this reason we cannot favour the publication either of the ingredients or the analysis of our own private mixtures.

We are fully alive to the necessity of maintaining the good reputation our mixtures enjoy at the present time, and it is hardly necessary for us to point out that our business can only continue as long as we offer buyers the best value for their money.

There is no incentive, therefore, to large firms such as ourselves, to put low grade or unsuitable mixtures on the market, whereas, if we worked on the lines you suggest, it is probable that a number of mixtures would, in a short time, be offering an inferior mixture with a more or less equivalent analysis to ours at a cheaper rate.

As mixed fertilisers are invariably sold in bag packing, we suggest that legislation against adulteration will prove extremely difficult to enforce. For instance, we would be prepared to guarantee the analysis of any mixture we supplied when despatched from one of our factories, but we would certainly accept no responsibility after lengthy storage outside our own custody, neither could it be said that, when despatched, the goods in question were not up to analysis. Fertilisers are sold almost entirely on results, and we are confident that legislation such as you have in mind will in no way prevent the unscrupulous mixture from continuing present practices: in fact, as shown above, it is likely to serve as an incentive to him to encroach on what is now a sound and safe business, built up after long years of experience by firms such as ourselves.

APPENDIX V.

NOTE DATED THE 23RD JULY 1934, ON SUBJECT NO. 12, EXPERIMENTS ON SOME METHODS OF DISINTEGRATING BONES BY PREVIOUS FERMENTATION.

Attention is invited to the attached note dated the 10th January 1934 (Encls. I) which was considered by the Fertilisers' Committee of the Imperial Council of Agricultural Research at its second meeting held in February 1934. The Committee's recommendations will be found in the enclosed extract from the proceedings of the meeting (Encls. II).

The subject is now for the consideration of the Advisory Board.

ENCLOSURE I.

NOTE, DATED THE 10TH JANUARY 1934, ON SUBJECT NO. 8, EXPERIMENTS ON SOME METHODS OF DISINTEGRATING BONES BY PREVIOUS FERMENTATION.

At the first meeting of the Fertilisers' Committee it was suggested that the possibility of easily disintegrating bones by previous fermentation should be investigated. Dr. Harrison and Dr. Sen (at Pusa) and Rao Bahadur Sahasrabudhe (Department of Agriculture, Bombay) undertook to carry out experiments. Dr. Sen and Rao Bahadur Sahasrabudhe have submitted notes on the subject (Annexures I—III). Copies of relevant articles by Dr. J. N. Sen, Rao Bahadur Sahasrabudhe and Mr. M. A. Hossain, reprinted from the "Agriculture and Livestock in India". Volume I, Part II, March 1931, Volume III, Part III, May 1933 and Volume III, Part II, March 1933, respectively and of an article on the availability of phosphates in Bone-meal by Dr. Lander and Dr. Dalip Singh (Volume II, Part II, November 1932 are also enclosed. (Not available now). The subject is now for the consideration of the Committee.

ANNEXURE I.

NOTE BY DR. J. N. SEN, M.A., Ph.D.

The question of conserving the phosphoric acid supply of soils has been engaging the attention of those interested in the cause of Indian agriculture. Of the three important manurial ingredients, nitrogen, phosphoric acid and potash, a somewhat unique position is occupied by phosphoric acid. It is generally admitted that in Indian soils there is no lack of potash. As regards nitrogen, work done in the provinces has established that there occur fairly large annual increments of nitrogen accruing from natural processes in the soil, although it is to be acknowledged that these increments are of a widely varying character in the different localities owing to the operation of causes which are not yet fully understood. Unlike nitrogen, the whole of the phosphoric acid originates from the disintegration of rock material out of which soil is formed. From the soils this constituent passes to vegetation and thence to animals where it accumulates most in their bony structures. It is thus seen that where adequate returns are not made to the soil, the recuperative processes going on in the soil of certain localities may not suffice to keep up a supply of available phosphoric acid which would be adequate for a vigorous growth of plants.

In view of the above it is very desirable that means should be devised to utilise within the country the large amounts of bones which are now

exported to foreign parts. The difficulties in this connection are mainly two in number. In the first place most of the cultivators have strong prejudices against the use of bones. It is expected, however, that when easy and convenient methods of treating bones are devised and their effectiveness in increasing crop yields is clearly demonstrated the ryots would not be slow to adopt their use. In this connection mention may be made of the case of night soil against which there was originally much prejudice but for which there now exists a brisk demand.

The second difficulty in the use of bones is due to their refractory nature. The cultivators find it well nigh impossible to crush bones with the means available to them and it is only when so broken up that bones are good fertilisers. Bones have a very slow rate of decomposition in the soil. The bulk of the phosphoric acid contained in big pieces is of no use to the immediate needs of the growing plants as they can only utilise the very small fraction of phosphoric acid which is being continually rendered available at the surface of the bone particles through the action of chemical and biochemical processes going on within the soil. When, however, bones are subjected to chemical treatment, *e.g.*, with sulphuric acid, and rendered "soluble", their manurial efficacy is vastly increased. Again, when the pieces are ground down their effectiveness is increased. For the natural recuperative factors which act on the surface of the bones have an enormously enlarged field of action when the particles are rendered very small and their superficial area thereby largely increased.

It is felt that the present industrial state of the country does not permit the general adoption of either the sulphuric acid process or the institution of powerful mechanical disintegrators.

At the First Meeting of the Fertilisers' Committee appointed by the Imperial Council of Agricultural Research held at Simla, in June 1930, it was suggested that "the possibility of easily disintegrating bone by previous fermentation should be investigated" and the representatives from the Pusa Institute, undertook to carry out some experiments on this subject. The investigation is not yet completed but a short account of the work done up to this time may prove to be of interest.

At the beginning it was thought desirable that the experiments should not be limited to methods of disintegration by previous fermentation only but that other methods should also be simultaneously examined. The following five methods suggested themselves.

- (1) Treating bones with superheated steam.
- (2) Treating bones with solutions of easily available chemical agents.
- (3) Fermenting bones with the additions of requisite composting materials.
- (4) Igniting the bones and recovering the calcium phosphate.
- (5) Subjecting bones to the action of adequate solvents so that the residues are rendered sufficiently brittle to be broken up by means at the command of cultivator.

Experiments on processes (1), (2) and (3) have been conducted and an account of the results is being given later.

As to method (4), this is relatively simple process as bones contain a fair amount of combustible material. As a matter of fact during the

Great War when there was a dearth of phosphoric acid, one of the biggest chemical manufacturers in India prepared large amounts of phosphoric acid, from calcium phosphate obtained by this process. The nitrogen contained in bones (which averages about 4 per cent.) is no doubt lost but the residue of calcium phosphate left can very easily be rendered fine and it is expected to be a very useful phosphatic fertilizer. As however, burning bones within the Estate would constitute a great nuisance no experiments on this line were attempted at Pusa. It is to be admitted, however, that this procedure is a simple one and it can be availed of by cultivators in villages.

Method (5) presents many advantages and had it been possible to adopt it in practice it would have been of great utility to decrease the bones with solvents and use the residue as a phosphatic manure and utilize the extracted fat for other purposes. It was felt, however, that it would be difficult to fit in the process with the existing industrial conditions in the country.

A consideration of the results obtained under methods (1), (2) and (3) will now be taken up. Before proceeding further it is however necessary to say a few words about the composition of bones. The mineral portion of bones consists mainly of tricalcic phosphate, along with some other lime compounds, as also small amounts of magnesium and other salts. Interlacing the complete mineral frame-work is the cartilage, composed of nitrogenous compounds. Fatty substances are associated with the cartilage. Stress is to be laid on the fact that bones show a wide degree of variation in composition. It varies with the age of the animal for instance, the bones of young animals are richer in nitrogen than those of the old and fatty matters occur to a greater extent in bones of fully developed animals than in those of ones only partially developed. It also varies with the nature of the bones; thigh and leg bones contain more fat than those of the head ribs and shoulders. The composition also varies with the previous history of storage; fresh bones are much tougher than old bones, and are richer in organic matter.

Short accounts of the experiments tried are now being given.

1. *Treatment with Superheated Steam.*

That bones can be rendered more brittle by subjecting them to the action of steam under pressure has already been known and in many bone treatment establishments this procedure is used. In the course of the present study some preliminary experiments were done with bones broken up to 3 to 4 inches length, which were heated in an autoclave for various lengths of time and at different temperature. It was found that with these, 2 hours' heating at 130°C yielded very good products. Big bones about 18" long had to be maintained at 130°—135°C for three to four hours. When the temperatures were maintained lower than 130°C a longer period was necessary, e.g., at 120°C, it was necessary to heat the bones for six hours or more. It may be mentioned here that in the above experiments the bones became so friable that they could be powdered with gentle pressure. Where the object is to render the bones only sufficiently brittle to be capable of being broken up with the help of a country *dhenki*, two hours heating at 130°C should do.

The samples of steamed bones obtained in the present experiments were, as noted above, very friable and they yielded to pressure by the

hand. During the process of heating some volatile products escaped with the steam and some material dissolved in the water. There is a loss of nitrogen but the phosphoric acid is conserved. There is a difficulty in preparing a representative sample of the original bones as they are in fairly big pieces but it can be taken that they contained about 4.5 per cent. nitrogen and 24 per cent. phosphoric acid (calculated on a dry basis). The steamed bone contained about 1.8 per cent. nitrogen and 26 per cent. phosphoric acid. The aqueous liquid on examination was found to contain 1.52 gms. nitrogen and 0.008 gram phosphoric acid for every 100 grammes raw bones taken for treatment.

It is of importance to compare the fertilizing power of the steamed bones with that of raw bones. It would be best to conduct field trials to test this point but here are certain other empirical methods which can be carried out in laboratory practice, among which is one of treating the material with a neutral solution of ammonium citrate of a definite strength (Sp. gr. 1.09 at 20°C) for a definite period of time ($\frac{1}{2}$ hour) and at a fixed temperature (65°C). The amount of phosphoric acid which thus passes into solution is taken to represent the degree of "availability". Steamed bones obtained in the present investigation were tested by the above process, along with a commercial sample of bonemeal obtained from Calcutta. As it was expected that solubility would be affected by the fineness of the material care was taken to divide the meal into different grades of fineness with the help of sieves. The following results were obtained.

Grams of P_2O_5 dissolved in ammonium citrate solutions from 100 gramme of P_2O_5 present in the bones.

Raw Bone Meal.			Steamed bone.
Particles above 1.5 m.m.	Particles between 1.5 and 1 m.m.	Particles below 1 m.m.	Particles below 1 m.m.
1.95	31.18	42.46	77.56

The figures recorded above are not strictly comparable. In the first place the raw meal was of a different origin from the steamed product. Secondly, it may be that the bigger particles of meal, which were separated by 1.5 m.m. sieve, were not only harder than the rest of the fractions and thus escaped disintegration, but were at the same time chemically more refractory than the residual part which passed through the 1.5 m.m. sieve. It is noted for example that the outer "vitreous" parts of bones are much tougher than the "spongy" material in the inside. And in the course of experiments to be referred to later it was observed that the former are more resistant to the action of chemical reagents like caustic alkalis.

But even acknowledging the above limitations when one considers the wide difference in the magnitude of the figures obtained in the ammonium citrate method of examination one has to agree about steamed bone meal being a very much more valuable fertilizer than raw bones. This is quite in accordance with the generally accepted view.

It is contemplated further to study this interesting point about the correlation between fineness of material and phosphoric acid availability.

The autoclave used in the above experiments was heated with gas and it had a capacity of about 9½ lbs. of bones. To work the process in an economic way, less expensive heating arrangements would have to be put up and cheaper and bigger apparatus would be necessary. Of course an arrangement which it would be possible for a cultivator to use would be the ideal but it is doubted whether such a method of autoclaving bones can be attained in actual practice. The next best procedure would be a moderately big but cheap, contrivance whereby bones collected in a locality can be treated say either by a co-operative agency or by a small capitalist and the product utilized by the cultivators in the outlying villages. An attempt is being made to get from a reputable firm of engineers specifications and rough estimates for such a model plant.

2. Treatment with Chemicals.

The action of solutions of various salts of sodium potassium and ammonium on bones at ordinary temperatures and in the heat was studied. Not much action was noticed in the case of any except of carbonate of sodium where the bones showed signs of yielding. Solutions of caustic alkalis, however, gave much better results. Addition of sodium chloride seemed further to favour the reaction. Trials were therefore conducted with solutions of various strengths of carbonates and hydroxides of sodium and potassium with and without the addition of sodium chloride, and the condition of the bones kept in the solutions was systematically observed every alternate day. It was noted that the higher the strength of caustic alkali, the quicker was the reaction to occur but that there was a limit of period of activity after which the reaction proceeded at a very slow rate; this period varied with the strength of alkali, being shorter in the case of the stronger solution. In the case of caustic soda solutions of strength below 1.5 per cent. and with caustic potash solutions below 2 per cent. in strength, the disintegration seemed to be negligible. The presence of sodium chloride was of help in accelerating the action. The following table will serve to illustrate the above observations.

Treatment.	Days after which action is perceptible.	Days after which action slackens.
Caustic Soda 2.5 per cent.	5	12
„ 2.5 per cent. + salt 1 per cent.	5	10
„ 2 per cent.	7	18
„ 2 per cent. + salt 1 per cent.	5	15
„ 1.5 per cent.	15	40
„ 1.5 per cent. + salt 1 per cent.	12	30
Caustic potash 2.5 per cent. + salt 1 per cent.	10	21
„ 2 per cent. + salt 1 per cent.	18	45

It seemed that a solution containing 1.5 per cent. caustic soda was of a very economical strength to be used for the purpose of breaking down bones. Experiments were next performed to find out what strength of salt had better be used in conjunction with the alkali. For this purpose mixtures 1 per cent. NaOH + 1 per cent. NaCl, 1 per cent. NaOH + 2 per cent. NaCl, 1.5 per cent. NaOH + 1 per cent. NaCl, and 1.5 per cent. NaOH + 2 per cent. NaCl, were used. Where 1 per cent. NaOH was used bones did not show evidence of reaction. Solutions containing 1.5 per cent. NaOH were quite useful and their effectiveness was the same whether 1 per cent. or 2 per cent. NaCl, was used.

The data enumerates in the following table illustrate the points mentioned above.

Treatment.	Duration of treatment.	Days after which the reaction slackened.	Bones.		
			Taken.	Disintegrated.	Not disintegrated.
1.5 per cent. NaOH alone	89 days .	40	1,000	518	482
1.5 + 1 per cent. NaCl	69 „ .	30	1,000	736	264
1.5 + 2 per cent. NaCl	69 „ .	30	1,000	723	277

Keeping the bones in 1.5 per cent. caustic alkali for three months disintegrated only half of them while in the case where 1 per cent. common salt was used in addition three-fourths of the bones were broken up during the course of two months. The bulk of the reaction, however, took place really within 40 and 30 days, respectively.

It may be mentioned here that when bones suffer disintegration through the action of alkalis it is the less resistant portions which are the first to yield, the action gradually proceeding to the more resistant fractions, but there are some portions (*e.g.*, some of the joints and specially the teeth) which are very refractory. As a result there is a fraction of the bones which escapes disintegration.

In these experiments bones were taken to be "disintegrated" when it was possible to break them up to coarse powder with gentle pressure in a porcelain mortar. The residual pieces of bones (which as noted above, amounted to about a quarter of their original weight) were after the treatment, left in a loosened and peculiarly laminated condition and much of these could be broken off by hand in the form of flakes. Vigorous pounding could also serve to crush them.

Chemical analyses showed that distintegration through the agency of alkali was associated with leaching out of organic matter. The product

was poorer in nitrogen and richer in phosphoric acid, as will be seen from the following table.

Treatment.	Composition of solid residuo (gms. in 100 gms. dry matter).					Final composition of liquid (gms. in 100 co.).			
	Ω $P_2O_5-O_{43}P_2O_5$.	Org. N.	Org. mattor.	Insolu- ble sili- cates and sand.		CO ₂	Alkali NaOH or KOH.	P ₂ O ₅	Org. N.
(Raw Bones)	27.27	59.53	4.45	30.57	2.40	2.37	..	..	..
2 per cent. Caustic Soda.	31.64	69.08	2.60	20.15	0.30	4.59	0.65	0.0058	0.51
2.5 per cent. Caustic Po- tash + 1 per cent. com- mon salt.	31.01	67.71	3.04	24.11	Traces	4.29	0.47	0.0043	0.42

The study is being continued to find out what solution would prove most economical from the point of view of effecting disintegration.

The experiments so far done had been all conducted on a small scale and in glass vessels. Larger amounts are being taken and vessels such as would be capable of being used by cultivators are being investigated.

3. Fermentation in Composts.

It is known that when bone meal is placed in heaps with suitable composting materials and appropriate conditions for fermentation are maintained, it enters into putrefaction and becomes a much more energetic manure than ordinary bone meal, the solubility of the bone phosphates being greatly enhanced as an indirect result of the processes of fermentation.

Attempts are being made to find out whether such fermentative processes are also effective in loosening the mechanical structure of pieces of bones. It has been thought worthwhile to find out what happens under broadly differing types of bio-chemical activities. With this end in view, various concomitant fermentative materials have been chosen to be mixed with the bones, *e.g.*, cattledung, urine molasses, waste curds, etc. To give body to the composts, additions of soil, sand and charcoal have also been made.

In one set of experiments bones, broken up to lengths of 3 to 4 inches, have been put in alternate layers with mixtures of above materials and then been allowed to ferment together in earthenware jars. Care is being taken to maintain the requisite moisture content by adding water when necessary to make up the loss by evaporation. Periodical examinations are being made of the composts to see how the bones are behaving. It is not yet possible to definitely state anything except that bones kept in

the compost containing sand, charcoal, dung and molasses are showing some signs of yielding.

For the above experiments the bones have been broken up to small pieces (3-4" long), an operation which entails some cost. It was thought desirable also to start some trials with unbroken bones. For this purpose another set of composts has been started and kept in pits in the ground. These pits, 4-ft. long \times 2-ft. broad \times 2-ft. deep, have been filled up just like the jars in the previous set containing alternate layers of composting materials and whole bones, the top layer of bones being of course also covered with the composting materials. These have been started since about two months and the contents will be examined later on.

Summary.

In view of the vital importance of phosphorous in promoting growth and development of crops it is highly desirable to increase the available supply of phosphatic manures to the cultivator, specially in those parts of the country where the soil is deficient in phosphates. In this respect bones constitute a good fertilising material, but the cultivators do not use it and large amounts are exported to the foreign countries. One of the important reasons why bones do not find favour with the agriculturist is due to their refractory nature. He finds it very difficult with the means at his command to break them up into a condition sufficiently fine to be of utility as a fertilizer.

Experiments are being conducted at Pusa to find out simple means of disintegrating bones. It has been found that subjecting bones to steam under pressure yields a good product. Promising results have also been obtained where bones have been treated with solutions of mixtures of caustic alkali and common salt. Another line of attack is being followed where bones are fermented with the addition of composting materials.

It would take some more time before the work is completed. In addition to studying methods of disintegrating bones it would be necessary to find out the fertilizing values of the products which would be obtained during the course of the work.

ANNEXURE II.

NOTE BY DR. J. N. SEN, M.A., Ph.D.

In the last report (Enclosure I), the various possibilities of disintegrating bones for use as fertilizers were discussed. Out of the several methods described, treatment with the solution of caustic alkali in addition with common salt, gave promising results.

Bones when kept dipped in solutions of alkalies of various strengths in air-tight glass jars for about a month or so suffered disintegration and a portion of the organic matter of the bones went in solution. The higher the strength of the alkali, the quicker was the reaction but there was a limit to the period of activity after which the reaction proceeded at a very slow rate. This period of activity varied with the strength of the alkali being shorter in the case of the stronger solutions. With caustic soda solution of strengths below 1.5 per cent., and with caustic potash solution below 2 per cent. in strength practically no disintegration took

place. Addition of common salt appeared to favour the reaction in two ways, *viz.*, (1) by accelerating the progress of the reaction and (2) by leaving the disintegrated bones in a less sticky condition. A fraction (about 20 per cent.), of the bones escaped disintegration, some of the shafts and the joints, and specially the teeth, being very slightly attacked. As caustic soda is available at a very cheap rate (-12/- per lb.), and as the strength of the solution required is less in its case than that of caustic potash, all the further experiments were carried on with caustic soda as the disintegrating agent.

1. Period of activity of caustic soda solutions.

A set of experiments was started to study the course of reactions of the alkali solutions of different strengths, during summer time when the average atmospheric temperature remained between 75°F (minimum) and 90°F (maximum) 100° grms. of bones were taken in each of several glass jars filled with 3000 cc of solutions. These were kept in an air-tight condition and the course of reaction noted daily. The following observations were made.

Treatments.	Action noticed to appear after.	Action noticed to slacken after.
1. Only caustic soda of—		
(a) 2.5 per cent. strength	5 days ..	12 days.
(b) 2.0 per cent. strength	7 days ..	18 days.
(c) 1.5 per cent. strength	15 days ..	40 days.
(d) 1.0 per cent. strength	No action ..	..
(e) 0.5 per cent. strength	No action ..	..
2. 1 per cent. sodium chloride and caustic soda of—		
(a) 2.5 per cent. strength	5 days ..	10 days.
(b) 2.0 per cent. strength	5 days ..	15 days.
(c) 1.5 per cent. strength	12 days ..	30 days.
(d) 1.0 per cent. strength	No action ..	..
(e) 0.5 per cent. strength	No action ..	..

The above observations showed, that in summer (1) the minimum strength of caustic soda capable of disintegration is 1.5 grm. per 100 cc water, (2) the stronger the solution, the less is the time required for complete disintegration, (3) in using 1.5 caustic soda the bones should be kept in the solution for a period of one month and half when sodium chloride is not used, and about one month when sodium chloride is used along with the alkali.

As is natural, the reaction is influenced by the important factor of temperature. It will be seen from results noted below that in winter,

when the atmospheric temperature remains between 50°F (minimum) and 75° (maximum) disintegration is completed only when the treatment extends for a further length of time.

1000 grm. bones were treated for different lengths of time, with 4000 cc. of alkali solutions (the amount of liquid was increased in this case) of 2.0 per cent. and 1.5 per cent. strengths with additions of 1 per cent. sodium chloride. The percentages of bones disintegrated within the periods are noted below.

Treatment.	No. of days treated.	Per cent. bones disintegrated.
1. 2 per cent. NaOH alone	30	65
2. 2 per cent. NaOH and 1 per cent. NaCl	30	70
3. 1.5 per cent. NaOH and 1 per cent. NaCl	15	12
4. Ditto	30	54
5. Ditto	45	75
6. Ditto	60	80

It is seen that, in winter the bones have to be kept in the 1.5 per cent. alkali for about two months for complete disintegration, and that even with 2.0 per cent. alkali only 70 per cent. bones disintegrated within the period of 30 days.

2. Alkali treatments on bigger scales. Experiments in canisters.

The experiments so far done, had been all conducted on a small scale and in glass vessels. It was next though advisable to carry on the work on bigger scales. The main difficulty in this connection was in selection of vessels for storing the alkali solutions. Caustic alkali, being highly corrosive, attacks ordinary vessels; and glass vessels cannot be used in large scale experiments owing to their high prices and to their fragile nature. After due consideration empty kerosine oil tins (canisters) were chosen for the purpose. The vessels have to be closed air-tight during the experiment otherwise the carbon dioxide present in air will considerably diminish the strength of the reacting alkali solution. The canisters were provided each with a small aperture in one corner of the lid through which the bones were introduced. A charge of 9 lbs. of bones could be conveniently dealt with in each canister. So much of the alkali liquid be taken was put, as would cover all the bones and would moreover remain at a height of at least 2" higher than the upper surface of the bones. Thus it is seen that the quantity of the liquid taken depends upon two factors, viz.,—(1) size of the bones and (2) the nature of the packing which the bones undergo in the canister. The majority of the bones available in the market are generally about one cubit in length and if this size is used, the ratio of the bones to solution should be 1000 grms. bones to 4000 cc, i.e., a relation of 1 : 4. But if the bones are broken to about

$\frac{1}{2}$ a cubit in length 3000 cc. liquid or a relation of 1 : 3 may be used. To avoid troubles due to improper packing, etc., the experiments tried were in the ratio of 1 : 4.

The commercial caustic soda used in these experiments contained about 72 per cent. pure NaOH. It has already been seen that the alkali solution must be of about 1.5 per cent. strength during summer and of about 2 per cent. strength during winter, for complete disintegration within a period of 45 days. It would be shown later that the use of alkali solution of 1.5 per cent. strength produces a better quality of bones with regard to the phosphoric acid and nitrogen contents, consistent with a low cost and a minimum of trouble. With this strength the period of reaction has, however, to be increased to about two months.

By the use of commercial caustic soda (72 per cent.) the proportions of the alkali and other materials work out as follows :—

Bone 9 lbs.

Caustic soda $\frac{3}{4}$ lb.

Common salt $\frac{1}{2}$ lb.

Water 36 lbs.

Regarding the quality of the water fresh and clean river water is to be preferred to well water, as the latter is generally hard and it thus considerably diminishes the strength of the alkali.

Closing the reacting vessel in a fairly effective way is essential for this work as has already been pointed out. This was done by pasting two pieces of paper over the aperture of the lid. After disintegration, the bones were freed from the alkaline solution, by first decanting off the liquid without disturbing the bones. To remove the adherent alkali they were washed 4 to 5 times with water, they were later broken up in the moist condition in an Okhri (wooden mortar).

Several experiments in tins have been made and as a result of the experience gained a convenient procedure has been evolved which will be described later.

3. *Experiments in brick-built chambers.*

Two masonry tanks, size 3-ft. \times 2-ft. \times 2-ft. each, were built in the ground and the insides were cemented. In tank No. 1 a charge of 56 kilos of bones was treated with 225 litres of solution containing 5 lbs. of common salt and 14.3 lbs. of commercial caustic soda (72 per cent. variety). Thus the strength of the solution in No. 1 tank was 2 per cent.

In tank No. 2 the strength of the solution was 1.5 per cent. 56 kilos of bones were treated there with 225 litres of liquid containing 5 lbs. of common salt and 10.7 lbs. commercial caustic soda.

The chambers were then closed air-tight. This experiment was done in winter during the months of January and February.

In tank No. 1 where 2 per cent. solution was used, after 45 days' treatment the bones were broken down to such an extent that the disintegrated mass got mixed up with the liquid when it was attempted to take them out. The "spent up" liquor could thus not be recovered and it was after 4 days that the bones were washed free from alkali with great deal of trouble. In tank No. 2 (1.5 per cent. alkali solution) the

bones were treated for two months. By this period these were disintegrated upto 80 per cent. of the amount used. These bones were softened satisfactorily and as they still retained their forms, they were recovered without much difficulty and a large amount of "used up" liquid was also recovered.

Comparing the advantages and disadvantages of using canisters, earthen vessels, and brick-built chambers it appears that canisters are to be preferred over the others.

4. Utilization of "used up" alkali solution.

An attempt has been made to utilize for disintegrating a further lot of bones such alkali solution as has previously been used for same operation. This solution contains combined alkali (as carbonates and bicarbonates) with a fraction of free alkali. The colour of the solution is darkened by the dissolution of organic matter from the bones. From theoretical considerations it is possible to use this alkali solution for disintegration of further amounts of bones if the requisite amount of caustic soda is added in it after each treatment, until the solution becomes overcharged with organic matter. As a matter of fact successful utilization of "pre-used" liquids have been made for the third treatment of bones. The amount of free alkali present in the solution was first determined and the requisite amount of caustic soda was added each time. A number of experiments with used up liquids for various periods have been carried out and some results are noted below. 1000 grms. of bones were treated with 4000 cc of the solutions.

Treatments.	No. of days treated.	Per cent. bones disintegrated.	Free alkali present in 100cc. solution.
1. 2 per cent. NaOH and 1 per cent. NaCl	30	70	0.99 gm.
2. 2 per cent. NaOH and 1 per cent. NaCl	60	85	0.90 "
3. 1.5 per cent. NaOH and 1 per cent. NaCl	45	75	0.67 "
4. 1.5 per cent. NaOH and 1 per cent. NaCl	60	80	0.66 "
*5. 2 per cent. NaOH alone	30	65	1.02 "
*6. 1.5 per cent. NaOH alone	60	70	0.72 "

It was seen that there is a fairly constant amount of residual free alkali maintained in the "used up" solution after treatments extending from 45 to 60 days. This amount is approximately 0.65 grams per 100 cc, with 1.5 per cent. NaOH and 1 per cent. NaCl, and 0.95 grams per 100 cc, with 2 per cent. NaOH and 1 per cent. NaCl. It follows that the residual alkali may safely be taken as $\frac{1}{3}$ of the total and $\frac{1}{2}$ of the total with 1.5 per cent. and with 2 per cent. alkali solutions, respectively. In the table above experiments 5 and 6 (marked with asterisks) demonstrated

higher amounts of free alkali present after the experiments, and this was associated with lower percentages of disintegration. Regarding the question of recovery of the liquid it was found that about $\frac{3}{4}$, or a little more, of the original solution can be conveniently poured off by decantation. Hence, for further utilization of the used-up liquid, the required amount of additional caustic alkali is to be dissolved in $\frac{1}{4}$ th the volume of water and this fresh solution and the liquid obtained by decantation from the previous experiment are to be mixed up for treating further charge of bones. As much salt is present in the used-up solution further additions of sodium chloride are not required in subsequent treatments. The proportions of used-up and fresh solution for subsequent treatments would thus be :—

Bones	..	..	..	9 lbs.
Used-up liquid	..	..	..	27 lbs.
Commercial caustic soda	..	..	..	$\frac{1}{2}$ lb.
Water	..	..	..	9 lbs.

5. Absorption of caustic alkali by the disintegrating bones.

It is very difficult to remove the last traces of caustic alkali from the disintegrated bones. In the usual course the bones are washed 4 to 5 times by decantation. For practical purposes this is sufficient to remove practically most of the alkali from the bones.

Experiments were conducted to see how much alkali still persists to remain in the bones. Selected and clean pieces of raw bones were crushed to $1\frac{1}{8}$ to $1\frac{1}{2}$ inches in length and treated with pure caustic soda and pure sodium chloride in the following proportions :—

Bottle 1	..	..	..	Crushed bone	..	100 grms.
				Caustic soda	..	1.5 grms.
				Sodium chloride	..	1.0 grms.
				Distilled water	..	400 cc.
Bottle 2	..	..	..	Crushed bones	..	100 grms.
				Caustic soda	..	1.5 grms.
				Sodium chloride	..	2.0 grms.
				Distilled water	..	400 cc.
Bottle 3	..	..	..	Crushed bones	..	100 grms.
				Caustic soda	..	2.0 grms.
				Sodium chloride	..	1.0 grms.
				Distilled water	..	400 cc.
Bottle 4	..	..	..	Crushed bones	..	100 grms.
				Caustic soda	..	2.0 grms.
				Sodium chloride	..	2.0 grms.
				Distilled water	..	400 cc.

The reaction was allowed to go on for two months. Care was taken to close the bottles air-tight. After two months when the disintegration was complete, the liquids were filtered and the bones washed 5 times in the usual way. The filtrate and the wash water were collected and analysed for sodium, by the uranium-zinc-sodium acetate method. The initial amounts of sodium present in each solution are known from the amounts of caustic soda and sodium chloride added ; the difference in the amounts of sodium in the initial and final solutions is to be attributed to retention of sodium by the bones. From figures in the table below it will be seen that the losses of sodium varied little with the different amounts of sodium

chloride used, but that it varied considerably with the amounts of caustic soda employed.

Treatments with 100 grms. bones in 400 cc. sol.	Total sodium in the sol. before treatment (calculated).	Total sodium in the sol. after treatment (observed).	Loss of sodium or sodium retained.	Corresponding caustic soda retained.	Mean caustic soda retained.
1. 1.5% NaOH ..	5.023	3.890	1.133	1.970	1.975
& 1% NaCl ..					
2. 1.5% NaOH ..	6.596	5.457	1.139	1.981	2.645
& 2% NaCl ..					
3. 2% NaOH ..	6.173	4.577	1.596	2.775	2.645
& 1% NaCl ..					
4. 2% NaOH ..	7.746	6.297	1.449	2.521	2.645
& 2% NaCl ..					

With 1.5 per cent. alkali 100 grms. of bone retained about 2 grms. of caustic soda. This amount of caustic soda is a negligibly small quantity. From the crop yields in Potculture House experiments to be described later, it was noted that alkali treated bones, containing this small amount of alkali, contributed considerably to better yields of *marwa* crops, as compared with yields from soil treated with commercial samples of bone-meals.

6. Analyses of alkali treated bones.

Experiments in the above sodium absorption studied were conducted under strict chemical control. The bones used for the experiments were very carefully chosen so as to be of the same quality. A representative sample of these bones before treatment was taken for analysis as also of the bones after they had undergone treatment. The following results were obtained.

Treatment.					Grm. per 100 gm. dry bone.		
					Organic Matter.	Phosphoric Acid.	Organic Nitrogen.
Raw bone for treatment ..	..	..	..	..	30.40	27.85	4.29
*1. 1.5 % NaOH ..	..	..	..	..	25.01	30.24	3.51
& 1.0 % NaCl ..	..	..	..	..
2. 1.5 % NaOH ..	..	..	..	..	24.61	30.13	3.57
& 2.0 % NaCl ..	..	..	..	..
3. 2.0 % NaOH ..	..	..	..	..	21.43	28.91	2.57
& 1.0 % NaCl ..	..	..	..	..
4. 2.0 % NaOH ..	..	..	..	..	21.36	28.64	2.83
& 2.0 % NaCl ..	..	..	..	..

A few points which emerge from a consideration of the above may be noted. By the alkali disintegration process the phosphoric acid content of the bones is increased and the bones are thus rendered more valuable fertilizers. Of the four treatments the proportion of 1.5 per cent. NaOH and 1 per cent. NaCl yields bones with higher amounts of phosphoric acid and nitrogen. By alkali treatment the content of phosphoric acid increases and the amount of nitrogen falls. This is of course a natural corollary, for the phenomenon of disintegration is produced by the solution of organic matter of the bones by the alkali solution. The loss of organic matter is less with 1.5 per cent. alkali as compared to steamed bone fertilizers, which contained not more than 2 per cent. organic nitrogen. Four samples of steamed bones prepared by autoclaving raw bones under pressure in the laboratory, gave the following figures for organic nitrogen on analysis.

Samples.	Organic Nitrogen % (dry basis).				
1	2.13
2	1.74
3	1.96
4	1.56

7. A convenient method for disintegration of bones.

A convenient method for the disintegration of bones by alkali process may now be described. This method is simple and by following it cultivators themselves will be able to prepare bone fertilizers for their use.

Preparation of the bones for treatment.—Bones as received from the collectors are fairly clean but some samples are at times very dirty, specially when they have to be taken out of pits. In such cases they should be subjected to a rough process of washing and the bulk of the dirt thus removed. Very green bones had better be avoided as the raw marrow and fleshy material present are likely to decompose in an unpleasant manner. The dry bones should then be broken to about half a cubit in length so that they can easily be put inside kerosine tins.

Preparation of the vessels.—Empty kerosine tins (canisters) having closed lids and each with only a small aperture in the lid, should be obtained. The opening should be cut on that corner of the lid which contains the aperture, keeping at least half an inch space from both the edges as shown below.

(Diagram printed on page 74 of the proceedings of the Fertilisers Committee, February 1934.)

It will be seen that the opening "O" is in the form of a quadrant of a circle; the radius or the length to be cut on each side is about four and half inches. This small width of space will enable pieces of papers being

pasted over the openings. As each tin conveniently deals with a charge of 9 lbs. of bones the description given below applies to such a unit charge.

8. *Preparation of the alkali solution.*

For this purpose the commercial variety of caustic soda (72 per cent. quality) may be used, as it is quite cheap.

Dissolve $\frac{1}{2}$ lb. of commercial caustic soda in 36 lbs. of clean water (river water preferred) contained in an open canister. Add $1\frac{1}{3}$ lb. of ordinary common salt (white variety preferred) and stir the whole mass with stick to get a homogeneous solution.

9. *Procedure for the treatment.*

Carefully pack the charge of bones inside the tin, and pour over them the prepared solution of alkali and salt. Take care that the bones are all covered by the liquid and that moreover the upper surface of the liquid remains at a level of at least 2 inches higher than the bones. Close the opening air-tight either by soldering a piece of tin or more simple by pasting two pieces of brown paper (greased paper will serve better). The tin is then stored for two months. In winter the reaction may be allowed to take place for 15 days more. Watch occasionally for any signs of leakage which, when detected, should be at once closed properly.

After the appointed periods, decant off the liquid into a separate canister and add enough water over the bones to fill up about half the tin. Shake up the tin and allow the bones to settle. Decant off the wash liquid which is to be thrown away. The operation of washing must be repeated till the bones are practically free from caustic alkali. A convenient test for this is to touch the moist bones with a finger after each washing and feel whether they cause any sensation of irritation to the finger. After 4 to 5 washings the bones will no longer irritate the finger, showing that these are free from alkalis.

Next take out these disintegrated bones and smash them up. For this purpose an wooden mortar (Okhri) may be used. Dry the finely broken bones by spreading them in the sun.

About 80 per cent. of the charge will practically be broken down. The remaining portion is composed of the more refractory fractions of the bones; which along with a fresh charge may profitably be subjected to a further treatment with alkali. If, however, the more refractory portion (namely, the teeth, etc.) are first eliminated almost the whole of the bones is found to be disintegrated in the first treatment.

10. *Subsequent treatments with the used-up alkali liquid.*

The used-up liquid contains about $1\frac{1}{3}$ of the original caustic alkali. Dissolve $\frac{1}{2}$ lb. of commercial caustic soda in 9 lbs. of clean water and mix this solution with 27 lbs. of the used-up liquid. 37 lbs. of this total mixture thus obtained is then used for treating a fresh charge of bones according to the method just described. Successful use of the "preused" alkali liquid has been made for treating a third charge. The liquid obtained after the third treatment contained in solution a very large amount of organic matter. This liquid without being thrown away may be used along with other manures (e.g., in improving the conditions of acid soils).

11. *Cost of the operation.*

In the villages bones are generally collected by employing depressed class coolies on daily wages. A man can easily collect one maund of bones per day and takes about 0-4-0 for the labour. The maximum cost involved in the collection of bones should not therefore exceed 0-8-0 per maund. Such cultivators as feel no objection in handling the bones, can take up the work of collection themselves and can thus get rid of the cost of getting the bones.

Besides bones the following materials are required.

1. Kerosine oil tin.
2. Commercial caustic soda.
3. *Common salt.*

1. *Kerosine oil tin.*—Empty kerosine oil tins are available in the market at prices near about 0-4-0 each.

2. *Commercial caustic soda.*—This important material is available from the chemical dealers in different grades of purity. In the present experiment a cheap variety (of 72 per cent. purity) has been used with satisfactory results. The price was 0-2-0 per lb.

3. *Common salt.*—The price is about 9 pies per lb.

The gross expenditure involved in the alkali process are thus estimated as follows.

Each tin deals with 9 lbs. of bones treated in the solution containing $\frac{3}{4}$ lb. caustic soda and $1\frac{1}{3}$ lb. common salt. Therefore, for treating 1 md. of bones (81 lbs.), about nine times as much materials would be wanted.

	Rs.	A.	P.
<i>First operation.</i>			
Bones 9×9 (81) lbs. at 0-8-0 per md.	..	0	8 0
Caustic soda $9 \times \frac{3}{4}$ (7) lbs. at 0-2-0 per lb.	..	0	14 0
Common salt $9 \times 1\frac{1}{3}$ (3) lbs. at 0-0-9 per lb.	..	0	2 3
Labour 2 days at 0-4-0	0	8 0
Total	..	2	0 3

12. *Each subsequent operations with used liquids.*

	Rs.	A.	P.
Bones 9×9 (81) lbs. at 0-8-0 per md.	..	0	8 0
Caustic soda $9 \times \frac{1}{2}$ ($4\frac{1}{2}$) lbs. at 0-2-0 per lb.	..	0	10 0
Common salt Nil.			
Labour 2 days at 0-4-0	0	8 0
Total	..	1	10 0

Assuming that the used-up liquid is used twice over the grand total for the three operations comes up to Rs. 5-4-3 and the average cost for each treatment amounts to Re. one and annas twelve only (Rs. 1-12-0 only).

If the cultivators do the operations themselves including the collection of bones in their spare time the cost will be as follows :—

	Rs.	A.	P.
1st operation—			
Prices for caustic soda and common salt ..	1	0	3
2nd operation—			
Price for caustic soda	0	10	0
3rd operation—			
Price for caustic soda	0	10	0
Total ..	2	4	3

In this case the average cost of each treatment will be annas twelve only (0-12-0).

13. Cost of other bone fertilizers.

The price of bone meal and bone superphosphate paid by this laboratory are given below.

Bones meals 80 lbs. Rs. 5-8-0 without freight.

Superphosphate 50 lbs. (18 per cent. P_2O_5 Rs. 3-6-0 without freight).

14. Cost of manuring an acre of land.

Comparison may be instituted about the approximate costs of these fertilizers in manuring an acre of land when it receives 40 lbs. P_2O_5 per acre.

(i) *Alkali treated bones*.—As this contains 25 per cent. P_2O_5 (on air dry samples) the amount of the fertilizers required would be 160 lbs. per acre.

Price of 160 lbs.

(a) @ Rs. 1-12 per 80 lbs. Rs. 3-7-3.

(b) @ -[12]- per 80 lbs. Rs. 1-7-3.

(ii) *Bone meals*.—This contains about 24 per cent. P_2O_5 and therefore the amount of these fertilizers required would be 167 lbs. per acre.

Price of 167 lbs. @ Rs. 5-8-0 per 80 lbs.

=Rs. 11-7-3.

(iii) *Bone superphosphates*.—It contains about 18 per cent. P_2O_5 and the amount of this fertilizer required per acre would be 222 lbs.

Price of 222 lbs. @ Rs. 3-6 per 50 lbs.

=Rs. 11-13-3.

15. *Potculture Experiments.*

To test the fertilizing capacity of these alkali disintegrated bones, it was considered worth-while to compare the effects on these alkali treated bones with those of bone-meal and bone superphosphates on crop yields. Of the soils used, one was a noncalcareous alluvium soil. (Kalyanpur near Cawnpore) and the other was an acid soil (Dacca).

Nature of the soils.—The Kalyanpur soil had a pH value of 7.94 and had the following mechanical composition—

				Per cent.
Clay	..	..	..	18.26
Silt	..	..	..	19.18
Coarse sand	..	..	..	1.5
Fine sand	..	..	..	57.84

The pH value of Dacca soil was 5.51 and on mechanical analysis it was found to consist of

				Per cent.
Clay	..	..	..	19.28
Silt	..	..	..	25.43
Coarse sand	..	..	..	1.46
Fine sand	..	..	..	54.0

The chemical characteristics of the two soils are noted below.

					Kalyanpur soil.	Dacca soil.
					Per cent.	Per cent.
Organic nitrogen	..	..	..	..	0.066	0.106
Organic matter and combined water	..	..	..	..	2.56	4.08
Total phosphoric acid	..	..	..	..	0.073	0.005
Available phosphoric acid (1 per cent. Citric acid method)	..	..	..	..	0.031	0.0016
Total potash	..	..	..	..	0.85	0.42
Lime	..	..	..	..	0.47	0.18

16. *Fineness of the fertilizers used.*

The fineness of patch of bone fertilizers are of much significance on crop yields. A sample of alkali-treated bone and one of untreated bones were sieved out into fractions of different fineness. Determinations of the so-called "available" phosphoric acid in these different grades by the 2 per cent. citric acid (Wagner's) method also show that the smaller the

sizes of the particles, the more soluble are they in 2 per cent. citric acid. The following table illustrates the fact.

Fineness of bone fertilizers.	Per cent. P_2O_5 soluble on total P_2O_5 or available P_2O_5 .	
	Alkali treated bones	Bone-meals.
Between—		
10—20 I. M. M. 	53.97	27.98
20—40 I. M. M. 	79.34	43.15
40—60 I. M. M. 	93.11	56.82
60—80 I. M. M. 	94.18	72.00
80—100 I. M. M. 	95.72	87.96
Finer than 100 I. M. M. 	98.42	93.64

It thus follows that for purposes of strict comparison bone fertilizers of the same grade of dimension should be employed. In the present set of pot experiments, the fractions between 20—40 I.M.M., representing the major portion of these bone products, were used. In the case of bone super this being very fine and completely soluble in water, the stuff as available in the market had to be used.

To study the influence of fineness on crop yield, there was also an extra set with alkali treated bones of a size finer than 100 I.M.M., utilized for treating Dacca soil.

17. Rate of phosphoric acid added.

Phosphoric acid was added to the soil at the rate 50 lbs. P_2O_5 per acre of land.

Treatment—The superficial 6" layers of soils obtained from Kalyanpur and from Dacca were filled in the usual way into pots of size 1' (height) \times 9" (diameter) which had a layer of gravel at the bottom. The jars were in triplicate.

18. Crops.

A kharif crop of marwa (*Eleusine coracana*) was grown, 4 plants being allowed to grow on each pot.

19. The plants.

The progress of the growth of the plants was systematically observed. When the plants were about 2 months old, they were photographed.

Plate No. I (not printed) illustrates the comparative effects of the 3 fertilizers on the growth of the Marwa plants in Dacca soil. The influence of alkali treated bones is quite evident from the size and freshness of the plants in pots No. 22 & 24.

Plate No. II (not printed) illustrates the effect of the alkali treated bones on the growth of the plants in Kalyanpur and Dacca soils. Dacca soil being initially poor in P_2O_5 has been benefited by this fertilizer.

Plate III (not printed) shows the remarkable effects of alkali treated fine bones (dimension finer than 100 I.M.M.), compared to alkali treated coarse bones (dimension between 20—40 I.M.M.) and bone superphosphate.

20. Flower counts.

Inflorescence of the plants was carefully recorded every day, the following tables give the number of flowers counted from each pot up to harvesting time.

Kalyanpur soil.

Treatments.	No. of flowers.			
	1st pot.	2nd pot.	3rd pot.	Mean.
No manure	6	7	5	6
Bone-meal	6	6	8	7
Alkali treated bones	8	6	5	6
Bone super	8	5	5	6

Dacca soil.

Treatments.	No. of flowers.			
	1st pot.	2nd pot.	3rd pot.	Mean.
No manure	4	4	3	4
Bone-meal	6	5	6	6
Alkali treated bones	9	9	8	9
Bone super	5	9	9	8

Flowering was not much influenced by phosphatic treatment in the case of Kalyanpur soils, whereas in Dacca soils the plants responded to the fertilizer additions. There were only 4 flowers each in the no manure pots but with alkali treated bones nine flowers per pot were produced. Alkali disintegrated bones stood first, then came super and next bone-meal.

21. Harvesting.

Before the plants were harvested the heads containing the grains were separated from the stalks. The stalks and the grains were then dried in the sun and the weights of the dried stalk and the grains free from chaffs taken. The following table illustrates the yields of total grain and stalks per pot.

Kalyanpur soil.

Pot No.	Treatments.			Weight of grain per pot (grms.).	Weight of stalks per pot (grms.).	Mean weight of grains per pot (grms.).	Mean weight of stalks per pot (grms.).
1	No manure	15.25	26.5	14.4	27.6
2	Do.	..	..	15.1	28.5
3	Do.	..	..	12.85	28.0
4	Bone meal	13.65	19.5	14.4	21.8
5	Do.	..	..	14.25	23.00
6	Do.	..	..	15.25	23.00
7	Alkali treated bones	17.65	28.00	16.3	24.8
8	Do.	..	..	16.30	23.50
9	Do.	..	..	15.00	23.00
13	Bone super	19.70	22.00	16.7	20.00
14	Do.	..	..	14.85	22.00
15	Do.	..	..	15.65	16.00

Dacca soil.

16	No manure	10.50	21.00	8.15	15.2
17	Do.	..	..	6.40	13.50
18	Do.	..	..	7.55	11.00
19	Bone meal	14.30	21.00	15.20	22.2
20	Do.	..	..	19.10	25.50
21	Do.	..	..	12.20	20.00
22	Alkali treated bones	18.90	26.50	19.10	24.2
23	Do	..	..	21.70	22.00
24	Do	..	..	16.70	24.00
28	Bone super	16.10	21.50	16.70	22.7
29	Do.	..	..	18.90	26.00
30	Do.	..	..	14.10	20.50

It is observed that in Kalyanpur soil which has high percentages of total (0.073 per cent.) and of available (.031 per cent.) phosphoric acid, responded little to additions of bone products but that Dacca soil being extremely poor in total (.005 per cent.) and in available (.0016 per cent.) phosphoric acid responded appreciably to the uses of these phosphatic amendments. The weights of both grains and stalks increased with the

addition of phosphoric acid, and of the three bone fertilizers used, alkali treated bones prepared at Pusa produced best effects.

22. Influence of fineness on the yields of crops.

The following table will illustrate that finer the dimension of the alkali treated bones used, the more was the product effective. This is also in conformity with the analytical results obtained in the laboratory experiments with different grades of bones recorded above. The following table gives comparative values of crops yields from the use of alkali treated bones (fine) with those from the use of superphosphate and alkali treated bones (coarse).

Dacca soil.

Pot No.	Treatment.	Weight of grains per pot (grms.).	Weight of stalks per pot (grms.).	Mean weight of grains per pot (grms.).	Mean weight of stalks per pot (grms.).
28	Bone super	16.10	21.50	16.70	22.7
29	Do.	19.90	26.00		
30	Do.	14.10	20.50		
46	Alkali treated bone (fine) ..	14.75	34.70	18.95	31.20
47	Do.	22.50	28.00		
48	Do.	19.60	30.00		
22	Alkali treated bone (coarse) ..	18.20	26.50	19.10	24.20
23	Do.	21.70	22.00		
24	Do.	16.70	24.00		

The superior action of the fine fractions of alkali treated bones is apparent.

23. Conclusions.

1. A simple method for the preparation of bone fertilizers has been described. The method consists in disintegrating raw bones in a solution of alkali containing 1.5 per cent. caustic soda and 1.0 per cent. common-salt. The bones are to be kept for about 2 months in contact with this solution in air-tight vessels. The ratio of bones to solution is recommended to be 1 : 4. After disintegrating a first lot of bones the used-up liquid can be used for at least two subsequent treatments with the addition of requisite amounts of caustic soda only.

2. A convenient process which can be availed of by the cultivators themselves is to use kerosine tins as vessels for effecting this disintegration. A charge of nine lbs. of bone is packed in each tin and 36 lbs. of solution containing $\frac{3}{4}$ lb. of commercial caustic soda (72 per cent. quality) and $1\frac{1}{3}$ lb. of common salt poured over the bones. The opening of the tin is closed air-tight by pasting two pieces of paper over it. After two months the liquid is decanted off to another tin and the bones washed 4-5 times with water by decantation. The moist disintegrated bones are then smashed up in an Okhri and dried.

27 lbs. of the used-up liquid is mixed up with 9 lbs. of fresh solution containing $\frac{1}{2}$ lb. of the caustic soda and the mixed liquid used for disintegrating a further lot of bones (*i.e.*, a second and third charge).

The cost of preparation of the alkali treated bones is very low. It is about Rs. 1-12 per maund when labour at As. 4 per day is taken into

account and only As. 12 per maund when the cultivators do the work themselves.

The prices of bone meals and bone superphosphates are about Rs. 5-8 and Rs. 5-8-9 per maund at Calcutta, respectively. The cost of manuring an acre of land by alkali-treated bones is cheaper than those by the use of bone meals and by bone superphosphates.

3. Potculture experiments have been carried out to test the comparative fertilizing capacities of the alkali treated bones with those of bone meals and bone superphosphates. The bone fertilizers prepared here by the alkali process have been found to be in no way inferior to superphosphates, they have produced better effects, in the present experiments on marwa in Dacca soil.

ANNEXURE III.

NOTE BY RAO BAHADUR D. L. SAHASRABUDDHE, M.Sc., M.A.G., AGRICULTURAL CHEMIST TO THE GOVERNMENT OF BOMBAY, POONA.

I.

Introduction.

At the first meeting of the Fertilisers' Committee of the Imperial Council of Agricultural Research held in June 1930 the question of crushing bones was discussed at some length and it was then decided that some definite experiments should be tried to find out some way of making the bones easy to crush by treating them before they are subjected to crushing.

It is a well known fact that bones are a valuable source of phosphoric acid—a constituent in which many of the Indian soils are deficient. Bones are ordinarily collected by low-caste people who get about Rs. 7 to Rs. 8 per ton for collection. This material is transported by carts and railways through various agencies to bone crushing factories where it is delivered at about Rs. 50 per ton. After charging about Rs. 20 for crushing and in addition paying agency and transport charges on the way back the bone meal is sold to the village cultivators at Rs. 130 to Rs. 140 per ton. Bones cut into $\frac{1}{2}$ inch and larger pieces are exported. This demand has now gone down and hence bone meal is a little cheaper. The details about collection, transportation and agencies are given in the appendix.

The bones have one great defect. They are not friable and brittle. They are tough and unless there is a special machine they cannot be crushed. By ordinary pressing they simply get flattened. It is hence that they must be sent to a special bone crushing factory in order to powder them. As the transport and agency charges cannot be cut down in this process there is very little hope of making bone meal cheap enough to be within the easy reach of cultivators. We must find out some process by which the bones can be made friable and can then be crushed in village centres without any costly machinery.

The Fertilisers' Committee asked me as one of the representatives of the Bombay Presidency to try experiments on the disintegration of bones to make them easy for crushing.

The results of these experiments have now been put together. In section V of the paper the economic side of the treatments is discussed in order to enable the workers to find out which of the processes experimented upon is the most suitable.

Experiments were made along three lines of treatments :— (1) By treating with chemicals, (2) by keeping in contact with bulky materials and (3) by heating.

The treatments along the first two lines require time and therefore they were taken up at once. Bones were weighed and put into suitable drums along with the chemicals or bulky materials. Each treatment had four to five drums. One drum from each treatment was taken at suitable intervals. Bones were removed from the drums, washed with water to remove the adhering material and well dried in the sun. A portion of this was then tested to determine the disintegration produced in the bones with regard to crushing.

To measure the change some arbitrary standard had to be fixed. It was therefore decided to pass a definite quantity of bones through a small ore crushing machine and find out the time required. The machine that was used is known as the Simplex Crusher, to be operated by hand. The accompanying photograph will give a clear idea of the same.

(Diagram printed on page 84 of the proceedings of the second meeting of the Fertilisers Committee, February 1934.)

(Diagram printed on page 85 of the proceedings of the second meeting of the Fertilisers Committee, February 1934.)

The only modification made in the machine was to replace the plane surface plates by grooved ones. The crushing plates in the machine are held in such a way that the opening at the top is wide enough to take large size bones, getting narrower towards the bottom end. The distance between the two plates is adjustable and during the trials the bones were passed twice through the machine.

In the first crushing large bones were broken into small pieces and in the second crushing they were reduced into sufficiently fine powder. During the first crushing the distance at the top between the two plates was 2.4 inches and the distance at the bottom end was 0.25 inch. At the time of the second crushing the plates were brought closer together with 1.8 inch distance at the top and 0.125 inch at the lower end. The crushed material was passed through 2 mm. sieve and weighed.

As all the treated bones were subjected to exactly the same process of crushing the results obtained are comparable.

A separate section is devoted to each type of treatment. In discussing each line of treatment it is clearly shown as to which of the treatments in that particular line is the best and is worth consideration so that in Section V only the most suitable treatments are discussed from the economic point of view.

Strong alkali solutions like 20 per cent. and 10 per cent. caustic soda disintegrate bones very quickly but these solutions are costly and difficult to handle. During the treatments the bones lose a good deal of the nitrogen in them. These treatments, therefore, will never pay and will never be accepted. Solutions of 5 per cent. caustic soda and 5 per cent. washing soda are sufficiently quick in action. Their cost is not very high and during the treatment the loss of nitrogen is not much and hence 5 per cent. caustic soda and 5 per cent. washing soda treatments deserve consideration.

Strong acids are out of the question both on account of their cost and the difficulty in handling them. Dilute acids like 2 per cent. hydrochloric or 2 per cent. sulphuric acid are very slow in their action and are not much better than water. These are, therefore, not worth consideration.

The bulky materials like cattle dung, urine, farm yard manure, etc., are all very cheap but so slow that these will not be accepted by men who want to start bone-crushing as a business concern.

Boiling with water is not of much use. Treatment with steam under pressure is very effective and makes the bones very easy to crush but the cost is a little too high. Roasting or half-charring of bones is very simple, clean and cheap. The bones treated by either of the processes are easily crushed. There is very little loss of nitrogen in roasting although there is some loss in half-charring. Even after making allowance for this loss the processes prove to be economically sound.

In filling drums and analysing samples Mr. N. R. Gurjar, B.Ag., of the chemical laboratory of the Agricultural Chemist, gave valuable help and deserves sincere thanks.

Treatment with Chemicals.

Bones were subjected to treatments with chemicals of two types—(a) and (b) acid.

(a) *Alkali Treatments*:—Under the alkali treatments there were (1) caustic soda, (2) washing soda and (3) caustic lime. The strengths of these were as follows:—

1. Caustic alkali 20 per cent.
2. Caustic alkali 10 per cent.
3. Caustic alkali 5 per cent.
4. Caustic lime 5 per cent.
5. Washing soda 5 per cent.
6. Washing soda 2 per cent.

It may be stated here that the first two treatments were taken only on theoretical considerations and for the sake of comparison as alkalies are very active on bones. In each case the chemical was added to water to

make up the necessary strength and this was added to bones kept in drums. The quantity of the liquid was enough to keep all the bones immersed in the liquid. The strength and the level of the liquid was kept up by adding water to make up what was lost by evaporation. For each experiment there was a series of drums and at fixed periods one drum from each treatment was taken. For short period experiments the quantity of bones was 5 pounds for each treatment, for each period; and in long period experiments the quantity of bones was 50 pounds for each treatment for each period. Taking for instance, the case of 5 per cent. caustic soda there were four drums each having 5 pounds of bones. Out of these one lot was crushed at the end of 24 hours, second at the end of 8 days and so on. In the case of 2 per cent. washing soda the treatment continued for 4 months. There were five drums each containing 50 pounds of bones completely immersed in the caustic material. One drum was taken at the end of the first month, another at the end of the second month and so on.

When the material was removed from the strong solutions of caustic soda a good deal of the material was found to form a bulk with the solutions. In such cases the whole bones were removed, washed with water, dried and crushed. The pulp that remained behind was dried. A part of this was washed well with water. Nitrogen was determined both from the washed and unwashed material. In such cases where pulp was not formed the bones were removed, washed, dried and crushed. Drying was done by exposing the bones to the sun for about 12 days.

The period for soaking the bones in 20 per cent. and 10 per cent. caustic soda was only 24 hours. For 5 per cent. caustic soda and 5 per cent. washing soda the trials were made for periods of 24 hours, 8 days, 16 days and 24 days; for 5 per cent. caustic lime the periods were 8 days, and 16 days and also one month, two months, three months and four months while for 2 per cent. washing soda the periods were one month, two months, three months and four months.

The quantity of bones found under each trial after drying but before crushing was as given below. Some loss on the original weight is expected due to drying but the rest of the loss must be attributed to the formation of pulp due to the action of the liquid in which the bones were kept.

TABLE NO. 1.

Showing the per cent. of dried bones recovered after treatment.

Treatment.	Period of soaking.			
	24 hours.	8 days.	16 days.	24 days.
	Per cent. of dried bones recovered.			
Caustic soda 20 per cent.	44.3	..	..	..
Caustic soda 10 per cent.	56.4	..	..	..
Caustic soda 5 per cent.	92.5	85.0	47.3	24.2

With other treatments the quantity recovered was about 95 per cent. which means that there was practically no formation of pulp with the chemical used for treatment. With 20 per cent. caustic soda the action is very quick. In 24 hours it breaks the bones to a pulpy condition to the extent of 55.7 per cent. For the same effect 5 per cent. caustic soda takes 16 days. The action of caustic soda is also seen on the bones recovered. They become friable. This action was tested by passing the dried bones through the crushing machines already described. The time required for crushing is in inverse ratio to the action of the chemical. 45 to 50 per cent. of the material twice passed through the machine could pass through 2 mm. sieve.

TABLE No. 2.

Showing the time required to pass bones twice through the machine.

Treatment and period of soaking.	Time required for crushing in minutes.	Treatment and period of soaking.	Time required for crushing in minutes.
Raw bones	95		
Caustic soda 20 per cent.—		Washing soda 5 per cent.—	
24 hours	15	8 days	33
		16 days	32
		24 days	28
Caustic soda 10 per cent.—		Washing soda 2 per cent.—	
24 hours	29	One month	62
		Two months	45
		Three months	28
		Four months	25
Caustic soda 5 per cent.—		Caustic lime 5 per cent.—	
24 hours	52	One month	40
8 days	10.5	Two months	35
16 days	10.5	Three months	34
24 days	10.0	Four months	30

It will be easily seen that the action of 20 per cent. caustic soda is very effective. We have, however, to take a number of facts into consideration. 20 per cent. caustic soda is too strong to be handled. The cost of the treatment is high and the pulp formed is highly alkaline and must be washed well before using on the land. 5 per cent. caustic soda is able to make the bones friable in 8 days to the same extent to which 20 per cent. caustic soda can make them friable in 24 hours. We have also to take into consideration the nitrogen per cent. in the treated bones before

we fix upon any treatment. The nitrogen in the treated bones is given in the following table :—

TABLE No. 3.
Showing the per cent. of nitrogen in treated bones.

Treatment and period of soaking.	Nitrogen per cent.	Treatment and period of soaking.	Nitrogen per cent.
Caustic soda 20 per cent.—		Caustic soda 5 per cent.—	
24 hours well washed and dried pulp.	0.17	crushed bones 24 hours ..	2.66
		8 days	2.76
Crushed bones	1.29	16 days	2.76
Caustic soda 10 per cent. pulp	0.65	24 days ..	2.78
Crushed bones	1.89		

The proportion of nitrogen as given above is from well washed material to remove the alkali as far as possible. Considering all points of view it will be seen that 5 per cent. caustic soda treatment for 8 days would be the most suitable if caustic soda is to be taken for treating the bones.

Taking now washing soda in two strengths the following percentages of nitrogen in well washed bones are obtained. There is no appreciable quantity of pulp formed with washing soda of the strength taken :—

TABLE No. 4.
Per cent. of nitrogen in treated bones.

Treatment and period of soaking.	Nitrogen per cent.	Treatment and period of soaking.	Nitrogen per cent.
Washing soda 5 per cent.—		Washing soda 2 per cent.—	
8 days	3.55	2 months	3.64
16 days	3.60	3 months	3.60
		4 months	3.58

In washing soda 5 per cent. seems to be far better than 2 per cent. in making the bones friable. There the loss of nitrogen also is not much. The best treatment with this chemical would be to soak the bones in 5 per cent. solution for 8 days.

Caustic lime also has a disintegrating action on bones. When it is mixed with water to the extent of 5 per cent. its action is a little better than that of 2 per cent. solution of washing soda in making the bones

friable but it is far below the action of 5 per cent. washing soda. Bones treated with caustic lime need not be washed for being used as manure. Nitrogen in the bones treated with caustic lime was found to be as follows :—

TABLE No. 5.

Nitrogen per cent. in bones treated with 5 per cent. Caustic lime.

Period of soaking.							Nitrogen per cent.
One month	..	..	..	..	..	..	3.30
Four months	..	..	..	..	..	..	3.14

Treatments which require long periods are not likely to be taken up by people as a practical proposition and it is necessary to take the shortest period possible without increasing the cost too much. Hence 5 per cent. washing soda is likely to be more favourable than 5 per cent. caustic lime. The lime takes three months to bring about the same disintegration which washing soda brings about in 8 days. Out of the alkali treatments which need be considered from an economic point of view are :—

(1) 5 per cent. caustic soda.

(2) 5 per cent. washing soda.

(b) *Acid Treatments.*—It is well known that strong hydrochloric and sulphuric acids dissolve bones. But when our object is to find out a process which can be taken up by rural people to crush bones it is necessary to avoid, except on theoretical grounds, strong acids which are costly and also bad for handling. Hence only 2 per cent. solutions of hydrochloric acid and sulphuric acid were taken. Bones were kept in these acids and also in water for comparison. The comparative friability of the treatments can be judged from the following table :—

TABLE No. 6.

Minutes required for 1.5 pounds of dried bones to pass through the crushing machine.

Treatment.	One month.	Two months.	Three months.	Four months.
		Number of minutes required.		
Water	63	45	45	32
Hydrochloric acid 2 per cent. ..	45	30	30	25
Sulphuric acid 2 per cent. ..	60	42	35	30

Raw bones require 95 minutes for 1.5 pounds to pass through the machine twice. (Table No. 2).

About 45 per cent. of the crushed material from acid treatment is fine enough to pass through 2 mm. sieve.

The table shows that hydrochloric acid has the highest action and water the lowest. But the acids in such low strengths do not show much advantage over water.

The 2 per cent. acids compare well with 2 per cent. washing soda giving practically equal actions in making the bones friable. By treatment with acids the percentage of nitrogen in bones calculated on dry matter is lowered.

TABLE No. 7.

Per cent. of nitrogen in bones treated with acids.

Treatment.	Nitrogen per cent.
Water—	
One month	4.04
Four months	4.04
Hydrochloric acid 2 per cent.—	
One month	3.62
Four months	3.03
Sulphuric acid 2 per cent.—	
One month	3.57
Four months	3.06

When all the factors are taken together such as nitrogen, friability of bones and cost of material, water proves to be more suitable than dilute hydrochloric or sulphuric acid.

III.

Treatment with bulky materials.

The bulky materials used for making the bones friable were (1) soil, (2) farm yard manure, (3) cattle dung, (4) urine and there was water also for comparison.

The weight of urine and water was double that of the bones while the weight of soil, farm yard manure and cattle dung was four times the weight of bones. The weight of the bulky material included 35 per cent. of water.

The bulky substances and bones were put in drums in alternate layers. The drums were covered well and the loss of water due to evaporation was made up from time to time. There were four drums under each treatment. When bones were removed for crushing they were washed to remove all adhering material and dried in the sun. One drum of each treatment was removed at each period. Out of all the bones that were dried

only 1.5 pounds for each treatment were crushed. The comparative friability is given below :—

TABLE No. 8.

Minutes taken to pass 1.5 pounds twice through the mill.

Treatment.	One month.	Two months.	Three months.	Four months.
Soil	60	47	29	25
Farm yard manure	60	38	34	32
Cattle dung	65	50	32	25
Cattle urine	50	33	32	25
Water	63	45	45	32

About 45 per cent. of the crushed material passes through 2 mm. sieve. Out of the bulky materials tried urine is the quickest.

The farm yard manure is a material which is rotted while cattle dung is not. The action of farm yard manure is quicker than that of cattle dung in the beginning but after three months cattle dung is more active. With all the differences that are shown above water seems to do well if the treatment continues for four months. Upto three months the other materials are more advantageous than water.

With regard to the nitrogen in the treated material we find the following percentages.

TABLE No. 9.

Nitrogen per cent. in bones treated with bulky materials.

Treatment.	One month.	Two months.	Three months.	Four months.
Soil	4.09	3.92	3.76	3.58
Farm yard manure	4.09	3.96	3.96	4.1
Cattle dung	4.16	4.15	3.88	3.84
Cattle urine	3.94	3.94	3.88	..
Water	4.04	..	..	4.04

In treatments with bulky materials the cost of the materials is not of much consequence since these materials are available on the farms and are ultimately added to the soil for which they are meant. But as the periods taken for disintegration are long they cannot be considered as useful treatment in crushing bones.

IV.

Treatment with heat—wet and dry.

Bones were treated with (a) wet and (b) dry heat and (c) they were also subjected to the action of charring.

(a) Wet heat.

Wet heating consists of heating the bones in contact with water or steaming them in an autoclave.

Three pounds of bones were boiled in water for (1) one hour and (2) for three hours. They were well dried and 1.5 pounds of each was subjected to the crushing test. Bones boiled for one hour took 43 minutes to pass twice through the crushing mill while those that were boiled for three hours took 32 minutes. The first lot contained 4.24 per cent. nitrogen while the second contained 4.14 per cent. nitrogen. The three hour boiling makes the bones slightly more friable than one hour boiling but does not show much advantage over one hour boiling. In autoclave steaming three pounds of bones were subjected to steam action at 140°C. for (1) one hour and (2) two hours. The bones subjected to two-hour steaming under pressure could be easily pressed and crushed by hand but not so the bones steamed for one hour only. Their friability and nitrogen per cent. are given below for comparison.

TABLE No. 10.

Minutes taken to pass twice through the mill and the nitrogen per cent. in bones.

Treatment.	Minutes required to pass twice through the mill.	Nitrogen per cent.
Autoclaved with steam at 140°C.—		
For one hour	8	3.83 46 per cent. passing through 2 mm. sieve.
For two hours	5	3.68 56 per cent. passing through 2 mm. sieve.

Steaming the bones at 140°C. for two hours makes the bones perfectly friable and if this is practicable in rural areas it will be an ideal process but this may not prove to be the process fit for rural areas at present.

(b) Dry heating.

In dry heating bones were heated in air oven. 3 pounds of bones were heated for 5 hours at 100°C. and another 3 pounds were heated for 5 hours at 150°C. On passing through the mill they gave the following figures :—

TABLE No. 11.

Time required to pass twice through the mill and Nitrogen per cent.

Treatment.	Minutes taken to pass twice through the mill.	Nitrogen percent.
Heated at 100°C. for 5 hours	15	4.15
Heated at 150°C. for 5 hours	13	4.39

Dry heating though not as effective as steam at 140°C. yet it has a sufficiently good action in making the bone friable and easy to crush. In this process there is no loss of nitrogen.

Since oven heating gave good results experiments in roasting bones on ordinary fire of dry leaves, etc., were tried. Ten pounds of bones were spread on an iron sheet put on a shallow pit to burn fuel. Another iron sheet was put on the bones as a cover. The fuel used was 1.5 lbs., 2.5 lbs. and 5 lbs. After the whole fuel was burnt, the bones were allowed to cool down and were then crushed. The results obtained were as follows :—

TABLE No. 12.

Time taken by 1.5 lbs. of bones to pass twice through the mill and also the per cent. of nitrogen present in the bones.

Treatment.						Min tes required to pass 1.5 l s. twice throu h the mill.	Nitrogen per cent.
With 1.5 lbs. of fuel for 10 lbs. of bone	..	..	..	..	..	20.5	4.12
With 2.5 lbs. of fuel	..	..	..	..	..	5.0	4.13
With 5 lbs. of fuel	..	..	..	..	..	10.5	4.41

Roasting on iron sheets seems to be quite effective in making the bones friable without loss of nitrogen. The whole process of heating does not take more than an hour. If large quantities are to be heated they must be spread evenly in one layer and roasted.

(c) *Half-charring and Charring.*

In order to avoid all care and trouble in roasting bones between iron sheets heating bones directly in contact with the fuel was tried. If the bones are burnt down they give us only the ashes which contain all the calcium phosphate but lose practically the whole of the nitrogen. Therefore charring and half-charring processes were tried. In this, dry leaves and farm refuse were used. For half-charring the quantity of fuel required is 10-12 lbs. for every 100 lbs. of bone and in full charring the quantity of fuel is about 16 lbs. per 100 lbs. of bones. The bones with these trials gave the following results by crushing. The charred bones can be easily crushed by fingers. The half-charred also are sufficiently easy for crushing :—

TABLE No. 13.

Time required by 1.5 pounds to pass twice through the mill and the percentage of Nitrogen.

Treatment.						Minutes re- quired to pass twice through the mill.	Nitrogen per cent.
Half charred	..	..	..	..	..	10	2.89
Full charred	..	..	..	..	..	5	1.55

Full charring requires more fuel and causes much loss of nitrogen. Half charring is a very simple process which does not take more than an hour for the full process and retains a sufficient quantity of nitrogen in the half-charred bones.

V.—The Economics of the processes tried for the Disintegration of Bones.

The prices of bone meal were very high till October 1930. As delivered at the factory the rates were 90 to 100 Rupees per ton, whereas they are now (in July 1931) 70 to 80 Rupees a ton. The price increases at least by one-third and many times by one half by the time the bone meal reaches a farm or a garden in a village, due, as already indicated, to transport and agency charges. Whatever be the processes recommended they must be examined in the light of the final price which the agriculturist will have to pay. It is, therefore, proposed to calculate the cost of the best processes under each type of treatment.

Under treatments with chemicals those with 5 per cent. Caustic soda and 5 per cent. washing soda may be taken to be the best of those that are tried and their costs may be calculated and similarly for other types.

VI.—Cost of treatment.

Caustic soda 5 per cent.—For every 100 pounds of bones the solution required is 200 pounds. The total quantity of solution for one ton of bones will be 4,480 pounds. At 5 per cent. the quantity of Caustic soda will be 224 pounds. If the rate of caustic soda is Rs. 344 per ton the cost of treating one ton of bones will be Rs. 34.4. The cost of washing the caustic soda from the treated material must be taken into consideration but the labour charges may be left untouched for the present.

Washing soda 5 per cent.—The quantity required for treating one ton of bones will be 224 pounds. If the washing soda is available at Rs. 152 per ton the cost of treating one ton of bones will be Rs. 15.2.

Bulky materials.—Treatment with bulky materials need not be taken into account since these bulky materials will be invariably available to the agriculturist as manures. Further, as the bulky substances act very slowly in making the bones friable, these treatments will not be of much use in the process employed to facilitate the crushing of bones and their costs need not be calculated at all.

Hot treatments.—Boiling with water is not of any advantage. Steaming under pressure has an excellent effect on making the bones friable, but the process is not within the scope of the rural people and may prove to be costly as it would come to about Rs. 40 per ton of bones.

Roasting on iron sheets and half charring seem to be the best suited to the village conditions.

Cost of roasting on iron sheets.—Good results are obtained by using 25 pounds of fuel to heat 100 pounds of bones; therefore for one ton of bones the quantity of fuel will be 560 pounds. The fuel used was waste hay or crop stubbles. These materials can be easily obtained at the rate of annas four per maund of 80 pounds. Therefore for heating one ton of bones the cost will be about Rs. 1-12-0. Cotton stubbles and dry leaves are very cheap in many places and the cost in such places for heating bones will be even less than this. The final product after

heating is 90 per cent. of the original quantity. Therefore the cost of fuel to obtain one ton of final product will be Rs. 1.95 or roughly Rs. 2.

Cost of half-charring of bones.—It is found that about 12 to 14 pounds of fuel is quite sufficient for half charring of 100 pounds of bones. For one ton of bones the quantity of fuel required will be 313.6 pounds. This at the rate of 4 annas per maund of fuel will be one rupee per ton. In one trial on half charring of bones the fuel charges for 1,475 pounds of bones were only annas two at Kumta and also in another trial at Dharwar the cost of fuel was found to be about annas 4 per ton of bones. The quantity obtained after half charring one ton of bones is about 70 per cent. ; therefore to obtain one ton of half charred bones the cost of fuel will be about annas six. It will be seen that in no case the cost of fuel for one ton of final product will be more than one rupee.

VII.—*Cost of crushing.*

The cost of crushing is another item which has to be taken into account. When labour on daily wages was engaged to crush half charred bones by stones the labour cost was found to be annas two to crush and sift 60 pounds of half charred bones at Dharwar and at Kumta labour charges for charring, crushing, and sifting were found to be Rs. 1-4-0 for 860 pounds of half charred bones. The Dharwar cost works at Rs. 4-11-0 and the Kumta cost works at Rs. 3-4-0 as labour charges. Roughly Rs. 5 might be taken as the charges for crushing one ton of half charred bones. The half charred bones and bones roasted on tin sheets with 25 per cent. fuel showed in the crushing test that 1.5 pound of each requires 10 minutes and 15 minutes, respectively. Therefore, roughly speaking, the cost of crushing roasted bones will be one-half times as much as that of crushing half charred bones. This means the charges for crushing one ton of roasted bones will be Rs. 7.5. Similarly for 5 per cent. caustic soda and 5 per cent. washing soda the cost of crushing one ton of treated bones will be Rs. 5 and Rs. 16, respectively. If instead of manual power bullock power is used and bones are crushed in lime mills the cost of crushing will be reduced by one-third at least. In place of Rs. 5, Rs. 7.5 and Rs. 16 the cost will be Rs. 3.3, Rs. 5 and Rs. 10-6.

VIII.—*Calculation of full cost.*

In full cost accounts the cost of the bones must come first. Practically in all the villages in the Bombay Deccan the charges paid for collecting bones are Rs. 7 to 8 per ton. But it may not be possible to crush bones in every village. It may have to be done in a suitable centre for a group of 30 to 40 villages. Under these conditions the transport and other charges will have to be taken into account. Rs. 4 for transport and Rs. 4 for agents, etc., per ton would be a reasonable charge and hence the cost of bones at such centres would be Rs. 16 per ton instead of Rs. 8. Calculations may be made for individual village work and also for rural centres separately.

It is now possible to work out the full cost for the treatments with :—

1. Caustic soda 5 per cent.
2. Washing soda 5 per cent.
3. Half charring.
4. Roasting on tin sheets.

1. *Caustic soda 5 per cent.*—85 per cent. material is obtained after treatment. Therefore, to begin with 1.2 ton of bones must be taken to get one ton of treated material. Bones are collected in villages at the rate of Rs. 8 per ton; the cost of 1.2 ton will be Rs. 9.6. After transport charges to a rural centre it will be Rs. 19.2 at Rs. 16 per ton. The cost of treatment will be Rs. 41.2 and the cost of crushing will be Rs. 3.3. Removal of the alkali by washing may cost one rupee per ton.

2. *Washing soda 5 per cent.*—85 per cent. material is obtained after treatment. Therefore to start with 1.2 ton of bones must be taken. The cost will be Rs. 9.6 in a village or Rs. 19.2 at a rural centre after paying transport charges, etc., the cost of treatment will be Rs. 18.5, cost of crushing Rs. 10.6 and of washing alkali, etc., rupee one.

3. *Half charring.*—70 per cent. material is obtained after treatment. Therefore 1.43 ton of bones will have to be taken at the beginning in order to get one ton of the final material. This will cost Rs. 11.5 in a village or Rs. 23 at a rural centre. The cost of charring will be rupee one, to obtain one ton of half charred material and the cost of crushing will be Rs. 3.3.

4. *Roasting on tin sheets.*—90 per cent. of the original material is obtained after treatment. To get one ton of treated material 1.1 ton of bones must be taken to start with. The cost of bones, therefore, will be Rs. 8.8 in a village and at a rural centre Rs. 17.6. Cost of roasting will be Rs. 2 and of crushing Rs. 5.

By putting side by side all the expenses a good comparison can be made of them. In villages they will be as sketched below :—

TABLE No. 14.

Expenses to obtain one ton of final product of treated bones if prepared in a village.

Treatment.	Cost of bones to get one ton of final material.	Cost of treatment for obtaining one ton.	Cost of crushing one ton of the treated bones.	Total cost per ton for the final product.
	Rs.	Rs.	Rs.	Rs.
1. Caustic soda 5 per cent. ..	9.6	42.2 (including washing).	3.3	55.1
2. Washing soda 5 per cent. ..	9.6	19.5 (including washing).	10.6	39.7
3. Half charring ..	11.5	1.0	3.3	15.8
4. Roasted bones ..	8.8	2.0	5.0	15.8

The total cost per ton of bones including transport and agency charges to a rural centre would be Rs. 16 as shown in another place. The cost of one ton of treated material under this condition will be as follows :—

TABLE No. 15.

Expenses to obtain one ton of final product of treated bones at a central place in rural areas.

Treatment.	Cost of bones to get one ton of final material.	Cost of treatment.	Per ton cost of crushing the treated bones.	Per ton total cost for the final product.
	Rs.	Rs.	Rs.	Rs.
1. Caustic soda 5 per cent. . .	19.2	42.2	3.3	64.7
2. Washing soda 5 per cent. . .	19.2	19.5	10.6	49.3
3. Half charring	23.0	1.0	3.3	27.3
4. Roasted bones	17.6	2.0	5.0	24.6

During the treatment of bones some amount of nitrogen is lost and since it is one of the valuable food constituents its value must be taken into account. The differences in the nitrogen percentage due to treatments are as given below :—

TABLE No. 16.

Nitrogen per cent. in one ton treated bones.

	Nitrogen per cent.	In one ton.
	Lbs.	Lbs.
1. Raw bones (original)	4.09	91.6
2. Caustic soda 5 per cent.	2.76	61.8
3. Washing soda 5 per cent.	3.60	80.6
4. Half charred	2.89	64.7
5. Roasted	4.13	92.5

In order to ascertain the total loss of nitrogen in the process it is necessary to deduct the amount of nitrogen present in one ton of the final product from that of the bones we take at the beginning to get one ton of the final product.

Table No. 17 gives the quantity of bones taken to obtain one ton of final treated material, total nitrogen to start with and the quantity of nitrogen in the final product and thus the loss sustained.

TABLE No. 17.

Treatment.	Quantity of bones to obtain one ton of final treated material.	Quantity of nitrogen to start with.	Quantity of nitrogen in the final treated material.	Loss of nitrogen sustained.
	Lbs.	Lbs.	Lbs.	Lbs.
1. Caustic soda 5 per cent.	2,688	109.9	61.8	48.1
2. Washing soda 5 per cent.	2,688	109.9	80.6	29.3
3. Half charring	2,723	111.4	64.7	46.7
4. Roasted bones	2,358	96.5	92.5	4.0

Sulphate of ammonia is sold at present at the rate of Rs. 14.5 per bag of 224 lbs. Taking 20.5 per cent. of nitrogen in sulphate of ammonia its price may be taken to be three pounds of nitrogen for one rupee. The loss of nitrogen when calculated in money value on this basis will be as follows :—

TABLE No. 18.

Loss in money due to loss in nitrogen calculated on one ton of the final product.

Treatment.	Loss in money due to loss in nitrogen.
	Rs.
1. Caustic soda 5 per cent.	16
2. Washing soda 5 per cent.	9.7
3. Half charring	15.5
4. Roasting	1.3

During the treatments there is also change in the proportion of phosphoric acid. Though there is no addition or loss of phosphoric acid yet the reduction of the organic matter and in some cases of the moisture also enhances the percentage of it in the final product.

In order to get one ton of the final product, different quantities of bones must be taken for different treatments as already indicated. Whatever be the amount of phosphoric acid in the original quantities of bones, its percentage must be determined ultimately in one ton of the product.

Since in each treatment the quantity of the original bones is more than one ton, the end product will contain more of phosphoric acid per ton than the original bones. This excess will increase the value per ton of the final product. The increases obtained per ton in each treatment are given below :—

TABLE No. 19.

Treatment.	Quantity of bones to start with to get one ton of final product.	Quantity of phosphoric acid in the quantity of bones taken for treatment and which remains in one ton to final products.	Quantity of phosphoric acid in one ton of original bones.	Increase of phosphoric acid in one ton.
	Lbs.	Lbs.	Lbs.	Lbs.
1. Caustic soda 5 per cent. ..	2,688	661.2	551.0	110.2
2. Washing soda 5 per cent. ..	2,688	661.2	551.0	110.2
3. Half charring	2,723	669.8	551.0	118.8
4. Roasting	2,358	580.0	551.0	29.0

Bone meal is sold at the rate of Rs. 80 per ton at present and in some factories it may be Rs. 70 per ton. It is, therefore, safe to calculate the present value of phosphoric acid in bones at 8 pounds per rupee. The net gain due to the increased phosphoric acid will be as follows :—

TABLE No. 20.

Treatment.	Money value per ton of increased phosphoric acid.
	Rs.
1. Caustic soda 5 per cent. ..	13.7
2. Washing soda 5 per cent. ..	13.7
3. Half charring	14.8
4. Roasting	3.6

It is necessary now to find out the algebraical sum of the loss in money for nitrogen and the gain in money for phosphoric acid.

TABLE No. 21.

Treatment.	Loss in money due to loss in nitrogen per ton.	Gain in money due to increase in phosphoric acid per ton.	Total loss or gain in money.
	Rs.	Rs.	Rs.
1. Caustic soda 5 per cent.	16	13.7	2.3 loss.
2. Washing soda 5 per cent.	9.7	13.7	4.0 gain.
3. Half charring	15.5	14.8	0.7 loss.
4. Roasting	1.3	3.6	2.3 gain.

Now by adding the loss to and deducting the gain from the total costs given in the Tables Nos. 14 and 15 the net cost of the treated bone product is obtained both for villages and for rural centres.

TABLE No. 22.

Treatment.	Net cost if prepared in village per ton.	Net cost when prepared in a rural centre per ton.
	Rs.	Rs.
1. Caustic soda 5 per cent.	57.4	67.0
2. Washing soda 5 per cent.	35.7	45.3
3. Half charring	16.5	28.0
4. Roasting	13.5	22.3

IX.—Conclusions.

Only a few agriculturists that require large quantities of bone meal or phosphates will prepare the products for themselves in their own villages while generality of people will buy a prepared stuff. It is, therefore, evident that the costs calculated for village centres are important. The costs for manipulation in treating bones with caustic soda or washing soda will not suit any dealers. But the processes of half charring or roasting are simple and cost only very little. If small rural centres are established by some people for these processes the agriculturists will get crushed bones cheap enough to be within their means, say, at about Rs. 35 per ton, and leave a sufficient margin of profit to those who establish such small concerns.

Finally it may also be stated here that the material obtained by roasting or charring is quite inoffensive and very convenient to handle and to store. During charring a very slight smell is emitted to handle and that it is not even noticed by any one in the surrounding area.

APPENDIX.

A note on the Collection and Crushing of Bones in the Bombay Deccan.

I.

General Process of Collection and Transport.

It is the customary right of the village Mahars to claim the dead bodies of the animals of their villages. The Mahars remove the skin and the flesh. The skin is sold and the bones are generally thrown away uncared for. They are nobody's property and therefore may be collected by any one. Usually Mahars and Mangs collect these and sell them to small agents who go from village to village for bones. These small agents are Mahars, Mangs or Mohomedans.

2. The small agents pay the village Mahars and Mangs at some fixed rates per basket or per bag and carry the bones in carts to the centres near railway lines. From these centres bones are taken by rail to factories for crushing or sold for export from Bombay.

3. The bones are exported to Colombo, Mauritius, Marseilles, Antwerp, Hamburg, etc. The export agents buy either whole bones which are well dried or crushed bones which are about an inch or so in length.

4. In some factories all the bones are crushed to bone-meal, but in others bones are first crushed to get one inch, three-fourth inch, etc., bones which are exported and all the rest of the portion is turned into bone-meal.

Near Kalyan one factory used to prepare bone super-phosphate from whole bones but this is now stopped. The exported bones are used in foreign countries for the extraction of gelatin and the residue used for manures.

5. Bone crushing factories or bone crushers are found chiefly in the vicinity of Thana or Kalyan near Bombay. The other factories are at Bijapur, Hubli, Ahmednagar and one crusher at Baramati in the Poona District. There is also a factory at Udhna near Surat, which crushes bones. Very few of the factories are working at present. Most of them crush only small quantities. It is said that the foreign demand for bones has gone down or at least the rate offered is very low.

6. The bone meal which is used in India is sold by the factories to agents or to men who prepare mixtures of manures and thus the return journey starts. The bones after passing through the hands of the agents go back to the land.

II.

Charges for Collection and Transport of bones.

7. The village Mahars and Mangs who collect bones get four annas per maund of 80 lbs. all over the Deccan as labour for collection. This comes to Rs. 7 only for one ton. The prices at other places after transport vary. They are, therefore, given separately for each place.*

*In obtaining information valuable help was given by the District Agricultural overseers of the Bombay Agricultural Department.

8. In Sholapur District the people who collect bones are paid at the rate of annas 6 to 8 per 80 lbs. of bones, *i.e.*, at Rs. 10-8-0 to Rs. 14 per ton.

9. Round about Poona bones are collected at Rs. 7 per ton and are transported in bullock carts (distance 40 miles from Poona) by small agents at Rs. 16 per ton and sold to Mahomedan agents in Poona for Rs. 28. The sub-agents thus get Rs. 11 as profits. The Poona agents sell the bones at Rs. 60 to 70 getting a profit of Rs. 22 to 32 per ton.

10. At Baramati (District Poona) there is a small crusher. The owner of this crusher gets bones at Rs. 4 for a palla. This palla is usually of 260 lbs. instead of 240 lbs. It works at Rs. 34-8-0 per ton. This is the price after the bones pass through the hands of the small agents who have to pay for transport upto the crusher and get their own agency charges.

11. In Satara District the traders coming from Bombay and Thana side pay Rs. 1-4-0 per maund to the small agents. This also comes to Rs. 35 per ton.

12. In Ahmednagar District there is a crushing factory. Here the bones are brought at the rate of Rs. 1-8-0 per maund of 80 lbs. and therefore the price comes to Rs. 42 per ton. This is certainly very high. The factory owner sells the bone meal at Rs. 90 to 100 per ton.

13. Round about Thana and Kalyan bones are bought by the factories at the rate of Rs. 50 per ton from the agents. These are sold for export at Rs. 60 to Rs. 65. If crushed they are sold at Rs. 75.

One of the factories near Kalyan takes bone meal from Udhna at Rs. 75 which comes to Kalyan factory delivery at Rs. 90. The factory after re-bagging sells the material at Rs. 110. The agents in the markets sell the bone meal at Rs. 125 so that by the time the bone meal goes to the village its actual cost to the cultivators comes to somewhere between Rs. 130 and Rs. 140.

14. According to the information given a factory near Bijapur gets bones delivered at the factory at Rs. 65 (?) When one ton of bones are crushed to get one inch bone they get only half a ton of the material, the remaining half ton being turned into bone meal. The factory sells the bone meal at Rs. 60 per ton and one inch blocks at Rs. 90 per ton. The blocks are exported to Antwerp, and Marseilles.

15. In the forest areas of Dharwar and Belgaum districts bones are sold at the rate of one and half to two rupees a cart which is equal to six to eight rupees a ton. The same is the case in many parts of North Kanara district.

16. It is clear from the information given above that the bones are collected at Rs. 7 per ton in a village. The same bones after transport to a crushing factory and back are available to the village at such a high price as Rs. 130 or more per ton. The actual crushing charges may be taken to be about Rs. 20 but the rest of the charge is all due to transport and agencies at various stages. These put the use of bones beyond the means of the cultivators. It is therefore of great importance to find out a process by which the bones may be crushed or disintegrated locally to avoid expensive transport and agency charges.

ENCLO. II.

EXTRACT FROM THE PROCEEDINGS OF THE FERTILISERS' COMMITTEE,
FEBRUARY 1934.*6. Experiments on some methods of disintegrating bones by previous fermentation (Subject No. 8 of the Agenda).*

Rao Bahadur Sahasrabuddhe explained the experiments which he had undertaken and the conclusions to which he had come on this subject which were explained in his note which formed enclosure 3 to the notes circulated on the subject. Dr. Lander referred to the experiments made by him on the subject of availability of phosphates in bonemeal described in his article which appeared in the Agriculture and Livestock in India in November 1932, where it was stated that the available phosphates in different grades of bonemeal, both stored and unstored, could be materially increased by an inexpensive treatment with urine, farmyard manure and ammonium sulphate for three months and it was recommended for farm practice. Rao Bahadur Viswanath suggested that the notes prepared on the subject indicated simple methods of disintegrating bones and that he would be glad if anything could be done to give effect to them. Mr. Carpenter expressed the opinion that it was clear from the papers circulated on the subject that it would be possible to grind bones locally and that he would be very glad to use bonemeal if it would be had at a suitable price. Colonel Olver stated that from the point of view of livestock it would be a very good thing to have bones converted into bonemeal in villages instead of being exported. Mr. Burt said that the information collected on the subject was very encouraging and referred to the experiments conducted by Dr. Sen of Pusa which had however not been followed up with field trials on account of Dr. Sen's retirement. He suggested that the work begun by Dr. Sen might be followed up by the Agricultural Departments in India. Rao Bahadur Viswanath suggested that the possibility of a grant of a bounty for fine crushing bonemeal on a large business scale be investigated. Dr. Singh suggested that bones be fermented before being ground as this was likely to make them grind easily. He would like some work to be done on these lines. Rao Bahadur Vagholkar suggested large scale trials being undertaken on the methods recommended by Rao Bahadur Sahasrabuddhe and Dr. Lander. In the end, the Committee agreed that schemes be invited with a view to (1) work being undertaken for purposes of demonstration on the basis of experiment carried out by Rao Bahadur Sahasrabuddhe and Dr. Lander, and (2) for composing crushed bones using if possible the 'prize' crusher if it passed its practical trials.

APPENDIX VI.

NOTE, DATED THE 3RD AUGUST 1934, ON SUBJECT NO. 13, APPLICATION FROM THE IMPERIAL INSTITUTE OF VETERINARY RESEARCH, MUKTESAR, FOR THE APPOINTMENT OF A RESEARCH OFFICER FOR FIVE YEARS TO INVESTIGATE INTO CONTAGIOUS ABORTION OF CATTLE, SHEEP AND GOATS AT AN ESTIMATED COST OF RS. 1,00,763 IF AN INDIAN IS APPOINTED AND AT RS. 1,44,141, IN CASE AN OFFICER OF THE NON-ASIATIC DOMICILE.

Attention is invited to the attached application from the Director, Imperial Institute of Veterinary Research, Muktesar (Enclo. I) for a grant for the appointment of a research officer and staff for investigation into contagious abortion in cattle, goats and sheep.

2. The Advisory Board (Enclo. II) at its meeting held in June 1930 once considered this scheme and recommended a sum of Rs. 1,45,400 spread over a period of 5 years. The Governing Body at its meeting held in July 1930 did not approve the scheme. The Animal Husbandry Wing of the Board of Agriculture at its meeting held in February 1933 (Enclo. III) again recommended that a special officer should be appointed for investigation into contagious abortion.

3. The scheme as now submitted involves a cost of Rs. 1,00,763 for 5 years if an Indian specialist officer be appointed and Rs. 1,44,141 if the officer be of non-Asiatic domicile. These estimates however include respectively a sum of Rs. 5,820 and Rs. 8,180 on account of house rent, which is not ordinarily allowed by the Council.

4. The subject is now for the consideration of the Advisory Board.

(ENCLO. I.)

COPY OF LETTER FROM THE OFFICIATING DIRECTOR, IMPERIAL INSTITUTE OF VETERINARY RESEARCH, MUKTESAR, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. G.1332, DATED THE 21ST JULY 1934.

SUBJECT:—*Proposal for a Research Officer to be appointed at the Imperial Institute of Veterinary Research, Muktesar, for investigation into Contagious Abortion of cattle, goats and sheep.*

Reference:—Your telegram No. F. 30-(1)-34/4, dated 18th July 1934.

I have the honour to forward herewith a scheme (Annexure) on the above mentioned subject, together with the requisite number of copies, for favour of placing the scheme before the next meeting of the Advisory Board of the Council, for consideration.

The Government of India have approved the scheme.

ANNEXURE.

PROPOSAL FOR A RESEARCH OFFICER TO BE APPOINTED AT THE IMPERIAL INSTITUTE OF VETERINARY RESEARCH, MUKTESAR, FOR INVESTIGATION INTO CONTAGIOUS ABORTION IN CATTLE, GOATS AND SHEEP.

It is an accepted axiom that the success and progress of Animal Husbandry is fundamentally dependent upon efficient reproduction of its young stock.

Not only are losses among young stock a source of direct economic damage, but they also tend to create an equally serious disadvantage of a more indirect nature.

This article has for its objective the demonstration, in as brief manner as possible, of how these direct and indirect effects are brought about by the distressing and troublesome disease of animals, known as Contagious Abortion.

In the minds of the majority of people, the problem associated with the preservation of young animals begins with their birth, but this view is erroneous, as a very considerable danger exists, on account of the above mentioned disease, during their prenatal existence. A young animal should be the object of hygienic care from the moment of its conception.

The object of this paper is to try to convince the members of the Advisory Board of the necessity for a grant to finance a thorough investigation into this most important and serious condition.

This disease will be briefly considered under two distinct but inter-related headings :—

- (a) Direct and indirect economic loss to the breeder.
- (b) Its relation to public health.

(a) A large amount of energy has been expended, and a vast store of literature and correspondence has been accumulated, in most civilised countries, during the attempt to elucidate the problems connected with immunisation against, and control of, Contagious Abortion. Although the advance has been considerable, the present position is far from satisfactory, and in India, information regarding this disease is less complete than in other countries.

This lack of sufficient reliable data are probably due, firstly to apathy or ignorance of the farmer, who in all probability does not know that there is a specific disease responsible for his losses and therefore does not report them, and secondly, to the meagreness of the veterinary staffs of the different provinces, who could recognise the disease if they were on the spot when abortion occurs.

A few years ago a survey, affecting very many hundreds of cattle, was undertaken in the Punjab. It was found that 25 per cent. of cattle were infected. This figure probably pertains to the cattle throughout India.

This does not mean that that percentage of cattle will abort in one year, indeed, we have no precise information in regard to the losses due to this disease which occur in the general bovine population of India.

It must not, however, be argued that lack of reported losses connotes an absence of disease, as this lack is most probably due to ignorance, or as stated before, absence of qualified men who would recognise it. The information already in our possession points to an universal distribution throughout India, and therefore the losses, which are intermittent, and almost insignificant at any particular time, are in effect, as great as, and possibly greater, than those due to some of the better known epizootic diseases.

The common casual organism of Contagious Abortion in cattle is *Bacillus Abortus*, Bang, but although this is the chief offender in connection with the disease under consideration, it is more than probable, that there are other very potent casual factors.

It is an unfortunate fact that in self-contained herds, where advance has been made in breeding a better type of cattle, this disease appears to be more intensive than in village cattle.

This may be due to reasons which remain as yet unexplained or uninvestigated, or it may be because the owners of these herds are better versed in diseases of cattle and therefore report these occurrences, or thirdly some of the abortions may be due to other casual factors, such as nutritional imbalance or deficiencies caused by more intensive application of practical methods for the increased production of milk. These are a few of the problems awaiting elucidation, but whatever the cause, it is wrong that the breeders who are making outstanding efforts at improvement of the cattle of this country, should be more penalised than those who are not.

The foregoing remarks apply to cattle, but in general they apply to goats and sheep in addition.

Outbreaks in goats causing serious losses have been reported from the United Provinces, the Central Provinces and the Punjab.

The loss of a single goat may appear negligible, yet the relative loss to the poorer owner is as serious as the loss of a calf of the more prosperous man, and when it is remembered that in many parts of India there is definite effort to improve goatbreeding, being undertaken, the losses from this disease will ultimately be found to be considerable. That the urge for goatbreeding is already in existence is shown by the schemes for the improvement of the goat, and grants already approved by this Advisory Board in recent years.

The same remarks apply to sheep.

In equines, the percentage of abortions varied from year to year, but it is shown that the disease is spread universally throughout the Indian peninsula wherever any horsebreeding is undertaken.

Although the primary object in putting forward this scheme is to endeavour to help the cattle, goat and sheep owner, there are large numbers of zamindars in parts of the country who still derive a considerable benefit from the breeding of horses. These are subjected to the same degree of loss, and individually probably larger, than the cattle breeder, but they are in the small minority. However, should this scheme meet with the approval of the Council, there could not be any objection to holding out a helping hand to the horse breeder also.

The above observations refer to the direct economic loss.

Regarding indirect loss it is usual when estimating loss due to diseases which cause abortion to include only actual abortions, but this method grossly underestimates the extent of actual damage brought about.

In addition to the loss by abortion, premature births, and weak and diseased offspring, which may live only a short time, and which may be the results of the same disease, must all be included in the estimate of real loss. Nor is the loss confined to the offspring, but the dam is all too often a permanent or prolonged temporary victim to the disease, on account of (a) a long period of convalescence or (b) a long temporary or permanent sterility due to a chronic metritis set up either by the casual agent or by secondary invaders.

Accurate information on the incidence of the above are not forthcoming in this country, but it is definitely known that *B. Abortus* Bang can cause such a sterility in cattle, but until much more work is undertaken, no accurate estimate of the loss due to this cause can be made.

The foregoing general remarks pertaining to the direct and indirect results which may accrue from this disease, will tend to bring about in some small degree an appreciation of the colossal damage done to the cattle breeders of India.

(b) Unusual interest has been shown in this disease of late because of the realisation that it is spreading and of its relation to undulant fever.

For several years the connection between Malda fever in Goats caused by *Bacillus Melitensis*, and undulant fever in man has been recognised. The very close relation between *B. Melitensis* and *B. Abortus* has of late years been the cause of very concentrated attention being given to these two organisms.

It appears now to be definitely established that *B. Abortus* of bovine origin may cause in man a form of undulant fever that is commonly benign, although sometimes protracted, and may be very severe, though death is exceptional, and there would appear to be a definite indication from the results obtained from the survey in the Punjab previously referred to that Indian cattle may not only be afflicted with the common casual organism *B. Abortus* Bang but also with *B. Melitensis* or closely related types of this organism, all of which are capable of setting up a more or less severe type of undulant fever in man.

It has been shown conclusively that milk from infected cows contains the organism in a fully virulent state, which is sufficient to incriminate the milk as a possible source of danger to human beings. It is not suggested that milk is the only source of infection as it has been shown that cattle may become infected by ingestion or through the unbroken skin so it is more than probable that the human subject may contract infection in the same manner. Thus it will be seen that cattle breeders and zamindars having infected cattle in their possession may constantly be exposed to risk of infection, indeed it has already been shown, although it is regretted that the relevant papers on this finding cannot be quoted, that in the Punjab cases of undulant fever in man are most prevalent in the districts in which cattle proved to be most heavily infected with Contagious Abortion.

Although the number of well established human cases is not impressive in relation to the wide spread infection in cattle, it can be readily understood that it is probable that in the past an exact diagnosis was not arrived at because it was not recognised that specific tests for the fever were necessary. The subject has now attracted a great deal of attention in medical circles so that it is unlikely that severe cases will pass unrecognised in the future.

The above remarks are probably sufficient to show that there is a definite relation between Abortion in cattle and goats, and questions of public health amongst human beings especially of rural areas.

The questions of eradication and control have been the subjects of controversy throughout most of the civilised world.

The methods pertaining to control have generally been confined to the use of dead and living vaccines.

It is now generally admitted that the former method is not of great material value.

Greater success has attended the use of a living vaccine, but the results are most unsatisfactory when the widespread nature of the disease is considered. Also when it is shown that the organisms can be eliminated by the milk stream it is certain that the injection of living organisms is injudicious from the point of view of public health.

A method which has proved the most successful, for the elimination of the disease from a herd, consists of dividing the herd into two portions, infected and non-infected, the two divisions being strictly isolated from each other. The infected herd is gradually eliminated while the non-infected herd is brought up to full strength.

Although this method approaches the ideal, it has the great disadvantage that it is very expensive to introduce, and on account of lack of facilities for segregation in this country, and on account of expense, its application to Indian herds would appear impracticable.

It must, therefore, be increasingly obvious that concentrated application is necessary in order to evolve a safe and reliable prophylactic measure.

With regard to the detection of the disease, it is accepted that the present method, whereby the agglutination test is used, is the most accurate of those at present in use, but it is far from perfect.

It is possible for animals to become spreaders of the disease before they will react to the test, also it may show a positive result when an animal has been, but no longer is, infected.

There are other tests but none of such a conclusive nature as to warrant a procedure of eradication of suspected cattle from a herd.

It will now be appreciated that considerable study and work will be required in order to elaborate a more satisfactory test than at present available.

Sufficient has now been written, in general terms free from technicalities, to demonstrate the importance of this disease on account of direct and indirect loss to the breeder, and to public health, also it will be appreciated that our knowledge of its ramifications, its detection, methods for control, are very incomplete. Although literature on the subject is vast, and investigations are attracting world-wide interest, yet our thorough grasp of the problems attaching to this disease is meagre.

The staff at the Imperial Institute of Veterinary Research at Muktesar is unable to devote sufficient time to the investigations necessary for the elucidation of the problems confronting them in connection with Contagious Abortion, and it is on this account, and on account of the realisation that some considerable help should be given to the cattle breeders of India, which have led to the submission of this article accompanied by a request for a grant to enable a special officer to be appointed for investigation into Contagious Abortion.

Should such an officer be appointed, the production of a suitable process of protective inoculation would be a matter for the most urgent investigation.

Secondly, intensive study is necessary to evolve a satisfactory means of diagnosis.

Thirdly, the evolution of a method by which the disease can be economically controlled in India. It is acknowledged that wherever the disease runs a somewhat chronic course, as it does in India, the chances of control are considerably greater than in countries where the disease is more virulent and severe.

Fourthly, the production, if possible, of an effective avirulent vaccine free from the objectionable features which attend the virulent or living type.

Fifthly, studies are necessary to determine the comparative importance of the various routes of infection.

Sixthly, the correlation of results obtained, in company with members of the medical profession, in order to demonstrate the possibility of *B. Melitensis*, the casual organism of Malta fever or related organism being udder invaders in cattle and thus become a further menace to public health.

It will be fully appreciated by the members of this Council that the officer's time will be occupied to the full in studying the above. Also it will be more than probable that problems, coincident to those already outlined, will arise, in the course of investigation.

It is requested that a Special Officer be appointed for a period of five years, as it is considered that a less period would not be sufficient for conclusive results to be obtained from such an investigation.

It is most desirable that it should be clearly understood that the officer would not be appointed as an Assistant to any other officer, but would be placed in complete control of the investigation.

This should be borne in mind when examining the proposition statements.

He would have his headquarters at Muktesar, and every assistance would be given in making available any knowledge at present in possession of the staff, or in the Library.

Alternative proposals for a suitable officer are put forward. It is assumed that there is no officer, either Indian or European, at present available in India, who would be able to take over complete charge of such an investigation.

Should a European be selected it would be essential that he should have had considerable experience in such work, and be virtually a master of the subject.

Should it be considered advisable that an Indian officer be appointed, it will be necessary that he be sent to England for a period of a year's further study in this disease and in methods of investigation directly bearing on it.

This would be essential on account of the available official being inexperienced, but it is considered that if an officer of the proper quali-

fication is obtained, a year's intensive study should equip him for the work.

Two proposition statements are appended.

W. TAYLOR,
Offg. Director,

Imperial Institute of Veterinary Research, Muktesar.

Enclo. :—Two statements.

Statement showing the recurring expenditure for an Indian Specialist Officer and staff for one year's training and five years for the investigation of Contagious Abortion.

	1st year.	2nd year.	3rd year.	4th year.	5th year.	6th year.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Pay of officer	3,900	7,800	8,220	8,640	9,060	9,480
Passage	2,000	..	..	..	..	..
Study allowance at 12 sh. a day ..	2,640	..	..	..	..	..
Fees, books, &c., during period of study	£50	..	..	..	..	..
Pay of one Veterinary Inspector at Rs. 200 per mensem ..	..	2,400	2,400	2,400	2,400	2,400
Pay of one Laboratory Assistant @ Rs. 50 per mensem ..	..	600	600	600	600	600
Pay of one Peon @ Rs. 15 per mensem .. .. .	..	180	180	180	180	180
Travelling allowance .. .. .	..	1,500	3,000	3,000	3,000	3,000
Travelling allowance of staff ..	..	500	1,000	1,000	1,000	1,000
Contingencies .. .. .	..	1,000	1,000	1,000	1,000	1,000
House rent @ 10 per cent. of amoluments of officer and staff ..	..	1,080	1,122	1,164	1,206	1,248
Contribution towards General Provident Fund (India) @ 6½ per cent. .. .. .	..	675	700	727	754	780
Total ..	8,540	15,735	18,222	18,711	19,200	19,688
£ ..	50	..	..	..	Rs.	1,00,096

£ 50

Or Rs. 1,00,763

This statement is prepared on the assumption that the Indian Officer selected will be sent to England for training for one year on half pay and

will receive study allowance at 12 shillings a day for 11 months (one month is left for the journey period from India to England and back). On rejoining duty he will start on Rs. 650 in the scale Rs. 650—35—790.

Statement showing the recurring expenditure for a Specialist Officer of non-Asiatic domicile and staff for five years for the investigation of Contagious Abortion.

	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
Pay of officer	12,000	12,600	13,200	13,800	14,400
Passage	1,000	..	..	..	1,000
Overseas Pay	£ 360	£ 360	£ 360	£ 360	£ 360
Pay of one Veterinary Inspector @ Rs. 200 per mensem ..	2,400	2,400	2,400	2,400	2,400
Pay of one Laboratory Assistant @ Rs. 50 per mensem ..	600	600	600	600	600
Pay of one Peon @ Rs. 15 per mensem	180	180	180	180	180
Travelling allowance of officer ..	1,500	3,000	3,000	3,000	3,000
Travelling allowance of staff ..	500	1,000	1,000	1,000	1,000
Contingencies	1,000	1,000	1,000	1,000	1,000
Contribution towards General Provident Fund @ Rs. 6½ per cent.	937	975	1,012	1,050	1,087
House rent @ 10 per cent. of emoluments of officer and staff	1,500	1,580	1,640	1,700	1,760
Total Rs. ..	20,680	22,360	23,020	23,680	25,340
	937	975	1,012	1,050	1,087
	£ 360	£ 360	£ 360	£ 360	£ 360

= Rs. 1,15,080
 Rs. 5,061
 = £ 1,800

} or Rs. 1,44,141.

(ENCLO. II.)

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

GOVERNING BODY MEETING, JULY 1930.

SUBJECT No. 9.—*Appointment of a Research Officer at the Imperial Institute of Veterinary Research to Investigate into Contagious Abortion among Domestic Animals.*

Extract from the proceedings of the Advisory Board, June 1930.

"Mr. Ware in opening the discussion briefly described the position in regard to research work at Muktesar which was that the routine work was increasing greatly but the number of veterinary research workers was decreasing. It was vital for the Muktesar Research Institute to get together an adequate team of well qualified research workers. Colonel Oliver speaking in support stated that the Board had before it four veterinary research schemes. He hoped that there would be more in future, especially schemes in regard to animal nutrition and a few schemes for local investigations in the provinces. Apart from the work of research at Muktesar which he anticipated would increase in volume and in scope as time passed, there was need also for local investigations in the provinces. It was not necessary that they should multiply research institutes; work could be done in the provinces without first setting up expensive buildings and in a small way. As the work grew and developed buildings would follow. It was due to her efficient veterinary services aided by preventive legislation that England had been kept as free from animal disease as she had been. What India had not so far realised was firstly the economic value of veterinary research and secondly the importance of team work in veterinary research. The cattle population of India was roughly 154 millions and yet if one worked out what was spent on actual research at the Muktesar Institute one would find that it did not come to more than two or three lakhs per annum. The trouble had been that so far the Muktesar Institute had been expected to pay its way. It was almost axiomatic that research could not be conducted satisfactorily on this basis. Even a commercial company when it financed a particular piece of research affecting its business did not finance the work on a profit and loss basis. The production of sera should be separate from the prosecution of research and he was happy to find that steps in that direction were now being taken by concentrating the production work, which in the past had to a large extent been carried on at Muktesar, at the Imperial Serum Institute at Izatnagar. As with Muktesar so with the provinces the need was now for men rather than for buildings. Mr. Milne supporting the scheme said that he had always felt that veterinary was a neglected science in India and that veterinary research should be encouraged. General Megaw was glad to see that the programme of work sketched out for Muktesar was a modest one; that was quite right. Research into the diseases of animals bore in some cases directly, in others indirectly, on human diseases; he therefore, welcomed the co-operation of the Veterinary Department with the Medical Department and he hoped that this would grow even closer than it had been so far. When he visited Muktesar he was struck by the complete lack of adequate personnel which was only sufficient to carry on the routine work of the Institute. He stressed Colonel Oliver's point that the need now was for men rather than for buildings and he was of opinion that only when Muktesar as an institute became inadequate for the needs of veterinary research should other research institutes be opened up. Colonel Schofield gave some examples of the losses due to contagious abortion in Military Farms. Mr. Quirke anticipated that with the increased domestication of animals in India this disease was likely to grow.

In the result, the Board decided to recommend to the Governing Body that a grant not exceeding Rs. 1,45,400 spread over a period of five years should be made to the Imperial Institute of Veterinary Research, Muktesar, for the appointment of a research officer for contagious abortion. The Board took this

figure as the maximum charge which would fall to the Council though it was possible that the total expenditure might be less if, for example, a suitable candidate were found in this country. It was further agreed that, if a grant in this connection was sanctioned by the Governing Body, the principle already accepted in regard to appointments involved in other schemes previously considered by the Board, *viz.*, that the officer should be recruited through the Public Service Commission, should be applied in this case also."

2. The proposals of the Advisory Board are now for the consideration and orders of the Governing Body.

M. S. A. HYDARI,
Secretary.

The 20th June 1930.

(ENCLO. III.)

EXTRACT FROM THE REPORT OF THE SUB-COMMITTEE ON LIVE-STOCK IMPROVEMENT
HELD IN CONNECTION WITH THE MEETING OF THE ANIMAL HUSBANDRY WING
OF BOARD OF AGRICULTURE AND ANIMAL HUSBANDRY.

* * * * *

*To review the effects of abortion, sterility and impotence on breeding operations
amongst domesticated animals. (Subject No. 13.)*

From the information placed before the Committee it is evident that considerable losses occur in the live-stock industry from infectious and contagious diseases of the reproductive organs in both cattle and horses. These are obviously an important factor in the economy of herds and studs now being maintained in this country. The Committee is therefore of opinion that a very strong case has been made out for the early appointment of a special research officer to investigate these diseases.

* * * * *

EXTRACT FROM THE PROCEEDINGS OF THE FIRST MEETING OF THE ANIMAL
HUSBANDRY WING OF THE BOARD OF AGRICULTURE AND ANIMAL HUSBANDRY
HELD AT NEW DELHI, FROM THE 20TH TO THE 23RD FEBRUARY 1933.

*To review the effects of abortion, sterility and impotence on breeding operations
amongst domesticated animals. (Subject No. 13 of the Agenda.)*

Mr. Quirke explained the economic importance of the effects of abortion, sterility and impotence on breeding operations among domesticated animals. Colonel Cole referred to losses caused by these and supported the recommendations of the Sub-Committee which when put to vote were carried.

* * * * *

APPENDIX VII.

NOTE, DATED THE 14TH AUGUST 1934, ON SUBJECT No. 15, PROPOSAL FOR THE APPOINTMENT OF STANDING COMMITTEES ON WHEAT AND RICE UNDER RULE 30 OF THE RULES AND REGULATIONS OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

Reference is invited to the note circulated to the Advisory Board regarding the recommendations of the Crop Planning Sub-Committee of the Board which met in June 1934. Two of the recommendations made by the Sub-Committee which were also endorsed by the Crop Planning Conference were to the effect that Standing Committees should be established by the Imperial Council of Agricultural Research on rice and wheat and financed from the Council's funds, their functions being to consider all matters relating to the production, marketing and general improvement of the two crops. Relevant extracts from the summary of the conclusions of the Sub-Committee and of the Crop Planning Conference are enclosed for ready reference (Annexure I).

2. As stated above the Committees will have to deal with all matters relating to the production, marketing and general improvement of rice and wheat and as such they will be required to review the statistical position of production and consumption (internal and external) thereof, marketing research and development of agricultural and technological research and advise on research policy. It is considered, therefore, that the Committees should be appointed by the Governing Body of the Council under Rule 30 of the Rules and Regulations of the Council (extract attached—Annexure II).

3. As regards the composition of the two Committees the attached skeleton composition (Annexure III) has been suggested by the Agricultural Expert to the Council as a basis for discussion.

4. The subject is now for consideration by the Advisory Board.

ANNEXURE I.

EXTRACT FROM THE RESUME OF DISCUSSIONS AT THE CROP PLANNING CONFERENCE HELD IN JUNE 1934.

Rice.

(i) that a Standing Committee on Rice should be constituted and financed by the Imperial Council of Agricultural Research. This Standing Committee should concern itself with all matters relating to the production, marketing and general improvement of the crop.

Wheat.

Finally, the Conference accepted the recommendation of the Sub-Committee that a Standing Committee on Wheat of the Advisory Board of the Imperial Council of Agricultural Research should be created on the same terms as those suggested for the Standing Committee on Rice.

ANNEXURE II.

Extract from the Rules and Regulations of the Imperial Council of Agricultural Research.

30. The Governing Body may, by resolution, appoint Sub-Committee for such purposes and with such powers as the Governing Body may think proper.

ANNEXURE III.

RICE COMMITTEE.

(a) Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, Burma, Bihar and Orissa, Central Provinces, Assam, Hyderabad, Mysore and Baroda.

(b) Eight representatives of rice growers (one each from the above provinces to be nominated by the Local Governments).

(c) Paddy Specialist, Madras,

 " " , Burma,

 " " , Bihar,

Economic Botanist, Bengal,

Economic Botanist (Rice), United Provinces,

Officer in charge, Central Provinces Rice Research Station.

(d) Two Professors of Economics (or University Readers).

(e) 1. One representative of Associated Chambers of Commerce.

 2. One representative of Federation of Indian Chambers,

 3. One wholesale rice merchant acquainted with import and export trade.

 4. One rice miller.

 5. } Trade members (to be selected).

 6. }

(f) *Officers of the Imperial Council of Agricultural Research.*

The Vice-Chairman (Chairman),

Agricultural Expert,

Marketing Expert,

Senior Marketing Officer (Rice),

Statistician, and

Secretary (*ex-officio*).

WHEAT COMMITTEE.

(a) Directors of Agriculture, United Provinces, Punjab, Bihar and Orissa, Hyderabad and Bhopal, Chief Agricultural Officer, Sind, Agricultural Officer, North-West Frontier Province.

- (b) Seven representatives of wheat growers (one each from the above provinces nominated by the Local Governments).
- (c) Director, Imperial Institute of Agricultural Research,
Second Imperial Economic Botanist, Pusa,
Cerealists, Lyallpur,
Rust Research Officer (Dr. K. C. Mehta),
Economic Botanist, Sind.
- (d) Two Professors (or University Readers) of Economics or Commerce.
- (e)
 1. One representative of Associated Chambers of Commerce,
 2. One representative of Federation of Indian Chambers,
 3. One representative of wheat trade in Karachi,
 4. One representative of wheat trade in the Punjab,
 5. One representative in the United Provinces,
 6. One representative of flour milling industry.
- (f) *Officers of the Imperial Council of Agricultural Research.*
Vice-Chairman (Chairman),
Agricultural Expert,
Marketing Expert,
Senior Marketing Officer (Wheat),
Statistician,
Secretary (*ex-officio*).

APPENDIX VIII.

NOTE, DATED THE 1ST AUGUST 1934, ON SUBJECT No. 16, REPORT OF
MR. K. P. R. KARTHA ON MILK PRODUCTION STATISTICS.

Attention is invited to the attached note* (Not printed) circulated to the Advisory Board in connection with its meeting held in February 1934. As stated therein the report by Mr. Kartha was submitted to the Standing Dairying Committee which met in March 1934 and an extract from its proceedings (Enclosure) is submitted to the Advisory Board for information. It may be added that arrangements have been made for continuing this work.

ENCLO.

EXTRACT FROM THE PROCEEDINGS OF THE FIRST MEETING OF THE STANDING DAIRYING
COMMITTEE HELD AT NEW DELHI IN MARCH 1934.

7. *To consider Mr. Kartha's resume of his work at Lahore (Subject No. 8 on the Agenda)*
—The Chairman enquired whether members had any remarks or criticisms to make. Mr Kothawala said that he had no remarks to make, except that he thought the work done was very interesting. Mr. Gossip said that the work so far done was essential and that in his opinion it was most important that the work should be continued. The employment of Mr. Kartha on the work had in his opinion been justified. The Committee made no further remarks and passed on to the next item.

*Please see Appendix XXXIX to the proceedings of the meeting of the Board held in February 1934.

APPENDIX IX.

NOTE, DATED THE 30TH JULY 1934, ON SUBJECT NOS. 17 & 18, (1) APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF RS. 29,070 SPREAD OVER THREE YEARS FOR A SCHEME OF RESEARCH IN APOICULTURE BY MR. C. J. GEORGE, PROFESSOR OF BOTANY, WILSON COLLEGE, BOMBAY, (2) APPLICATION FROM THE GOVERNMENT OF BARODA FOR A GRANT OF RS. 16,900 SPREAD OVER FIVE YEARS FOR A SCHEME OF RESEARCH ON BEE-KEEPING FOR GUJERAT.

Attention is invited to the attached letters (and enclosures), (1) from the Government of Bombay, No. 1762-A.33, dated the 8th February 1934, (Annexure I) and (2) from the Director of Agriculture, Baroda, No. 5906, dated the 26th June 1934 (Annexure II) forwarding the schemes mentioned above.

2. The Bombay scheme which is for a period of three years involves recurring expenditure of Rs. 24,180 and non-recurring expenditure of Rs. 4,890, or, a total of Rs. 29,070. It should be noted that the Government of Bombay undertake no financial responsibility for the scheme and that the receipts and recoveries included in the estimates are problematical.

3. The Baroda scheme is for a period of five years and involves, so far as the Council is concerned, a cost of Rs. 16,900 spread over that period.

4. The applications are for the consideration of the Advisory Board. In this connection, the attached extract (Annexure III) from the proceedings of the Board's meeting held in January 1931, relating to a scheme (Appendix XX, printed proceedings, January 1931) submitted by the Imperial Entomologist, Imperial Institute of Agricultural Research, Pusa, for the development of bee-keeping in India, which was rejected by the Council, will be of interest to the Board.

ANNEXURE I.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 1762-A.33, DATED THE 8TH FEBRUARY 1934.

SUBJECT :—*Research Scheme, Imperial Council of Agricultural Research.*
Application for grants from, for —.

In continuation of my letter No. 1762-A.33, dated 11th January 1934, I am directed by the Government of Bombay (Transferred Departments) to forward a scheme of research in apiculture by Mr. C. J. George, Professor of Biology, Wilson College, Bombay. The scheme was approved by the Provincial Agricultural Research Committee at a meeting held on 13th December 1933. The scheme is not one pertaining to the Agricultural Department in this Presidency. The Government of Bombay will not, therefore, be prepared to undertake any financial liability on account of the cost of the scheme. If the scheme is approved by the Imperial Council of Agricultural Research, the Director of Agriculture or any officer deputed by him, will undertake to inspect the work under it and will submit an independent report on the result of such inspection to the Advisory Board.

From

C. J. GEORGE, M.A., Ph.D., D.I.C.,

Professor of Biology, Wilson College, Bombay ;

To

THE SECRETARY, AGRICULTURAL ADVISORY COMMITTEE,

Agricultural College, Poona.

Through the Principal, Wilson College, and the Registrar,

University of Bombay.

Sir,

I have the honour to submit herewith an application for a total grant of Rs. 29,070 for five years from 1934 to 1939 from the funds of the Imperial Council of Agricultural Research in aid of research in Apiculture in the Bombay Presidency.

In this connection I may submit for your information a short account of my entomological experience which will indicate my competence to undertake and supervise this proposed research work. My general educational qualifications include an M.A. degree from Madras, a Ph.D. and D.I.C. from London. I have seven years' experience in entomological work at the Agricultural College, Coimbatore, and since 1930 have been an examiner in Agricultural Zoology for the Madras University. My contribution to the science of Entomology has been well received in scientific circles and my standing as an Entomologist will be evident from the fact that my work has been incorporated in the "Recent Advances in Entomology" and in the "Text Book of Entomology" by Dr. A. D. Imms, F.R.S. In 1924 I got interested in Apiculture and have been devoting some time to that subject. While at Coimbatore I studied the life-history, bionomics and metamorphosis of *Melipona*, the stingless bee, and a paper on the subject was submitted to the London University as part of my thesis for Ph.D. During my stay in England I spent some time at the Rothamstead Experimental Station and among other things gained more experience in Apiculture. Since last year I have been keeping some hives of *Apis indica* in Bombay for study. I spent last mid-summer holidays at Coimbatore and visited the two Apiaries, one at the Agricultural Station, and the other at the Y. M. C. A. Rural Reconstruction Centre. The Assistant in charge of the Apiary at the Agricultural College, Coimbatore, has prepared a short Bulletin based on the available information and the work was placed in my hands for suggestions and criticism, and I understand from him that it is now sent for publication..

I have, etc.,

(Signed) C. J. GEORGE.

Wilson College, Bombay :

18th December 1933.

A SCHEME OF RESEARCH IN APICULTURE.

I. INTRODUCTION AND HISTORICAL BACKGROUND.

Apiculture as a side line industry to Agriculture is practised in many countries. In some of these countries the industry is carried out on a large scale. Figures are not available on the output of honey for all these countries, but it is well known that thousands of tons of honey are exported by Canada, Australia and the United States of America. Though the possibilities of apiculture in India have received the attention of Government as early as 1883 when, as a result of an enquiry, Government of India published the replies from Local Governments under the title "A Collection of Papers on Bee-keeping in India", the industry is still in an infant state in India. One of the early attempts at culturing bees on scientific lines was made by the Agricultural Research Institute, Pusa. In 1910 and 1911 the Institute imported some colonies of the European bee. Later Mr. T. Bainbrigge Fletcher, Imperial Entomologist, published two articles on bee-keeping in the Agricultural Journal of India, Vol. VI, Part IV. A further consolidated account came out in 1914 as Bulletin No. 46 of the Agricultural Research Institute, Pusa.

During the years 1911—1916 Father Newton, S.J., conducted trials on the cultivation of the Indian bee *Apis indica*. His results were published in an article in the Agricultural Journal of India, 1917. The Department of Agriculture, Mysore, began the study of Apiculture with the Indian bee about ten years ago and have made good progress. Mr. S. J. Baldrey attempted culture of the Italian bee at Narsapur during 1926—1929. An account of his experience was published in the "Times of India Illustrated Weekly", dated 7th December 1930, 28th December 1930, 15th February 1931 and 22nd November 1931. Recently the Rural Reconstruction Branch of the South Indian Y. M. C. A. has taken up Apiculture (culture of *Apis indica*) with a view to popularise it among the Indian farmers. They have their centres at Coimbatore which is subsidised by the District Board and at Marthandam (Travancore). They have distributed so far over a total of 500 hives amongst the villagers. They help the villagers in finding a sale for their honey. They have now extended their work to the Indian States of Hyderabad and Baroda. The cultivation of the Indian bee has also been attempted at the Agricultural College and Research Institute, Coimbatore. At present the Entomological Section keeps about 30 hives and a qualified assistant is in charge of this work. I have no knowledge of the work in other provinces, but I understand that some other provinces like the Punjab are trying to popularise bee-keeping amongst the cultivators.

II. OUR PRESENT KNOWLEDGE OF THE INDIAN BEE.

On the question of the culture of the Indian bee, Mr. Baldrey and even the Pusa Bulletin strike a sceptic note. The attempts at culture cited above, however, have shown that the doubts raised are groundless and that the failures were due probably to imperfect technique. I have first hand knowledge of the work at Coimbatore and I have had a discussion recently with the Government Entomologist, Mysore. The data collected at both these centres are definite and the future is promising.

Mr. Baldrey, after a few years' attempts at cultivating European bees, abandoned his apiary and left for England. His hives and equipments were handed over to the Y. M. C. A., Coimbatore. At the time of my visit during the month of May, the Y. M. C. A., Coimbatore, had four hives of this bee. From my experience of bees, I cannot say that these bees are any way thriving. The Y. M. C. A. has a few more colonies of the European bee including a colony of the well known Carnolians. These hives appear worse than the Baldrey ones. The Baldrey hives, though they were brought to Coimbatore two years ago, the Secretary in charge told me that they have not yet yielded any honey. The records of the Indian bee of the same age are more satisfactory though it is a poor honey yielder compared to the other. The Indian bee is a smaller insect than the European bee and it is usually conceded that the latter is far superior to the former in the honey yield. But it has not been established that weight for weight the European bee is superior to the Indian. Even granting that it is so in its native environment, its records so far, in the plains of India, are far from satisfactory. With proper culture and facilities and pasture, the Indian bee could be made to yield a moderately good quantity of honey. The hives of Indian bees are necessarily to be small, but provided sufficient pasturage is available (for after all it is the pasturage that determines the honey flow) the smallness in size could be made up in numbers. From my observations I find that the Indian bee is as industrious as the European bee. The Indian bee has, however, two things in its favour. It is the native of the soil and is free from disease to which its European cousin is subjected. The only enemy is the wax moth but with proper care its invasions could be avoided. The record at Coimbatore and Bangalore shows that *Apis indica* is capable of yielding about 15 lbs. of honey per annum per hive. A farmer keeping 30 hives gets about 300 lbs. of honey per annum with proper care, and at a modest rate of Re. 1 per pound his income will be Rs. 300 per annum.

III. THE SCOPE OF APICULTURE IN BOMBAY.

Except the unsuccessful attempts of Mr. Baldrey and a few isolated attempts such as those of the Agricultural Station at Sangli, no organised effort at Apiculture has been made in the Bombay Presidency. That the Bombay Presidency offers extensive tracts of pasture for bees is undoubted. All over Deccan *Apis dorsata* alone is found and some quantities of honey and wax are collected annually. It is estimated from the experience at Coimbatore that an acre of cotton (Cambodia) yields about 20 lbs. of honey. The Bombay Presidency has extensive cultivation of cotton at Dharwar and Gujarat, and enormous quantities of honey are therefore going to waste every year, the honey collected from *Apis dorsata* colonies being negligible. Through bee-keeping this valuable food which is otherwise lost to the country could be redeemed. The Royal Commission on Agriculture has found that the diet of the Indian ryot was miserably poor and recommended that efforts should be made to enrich his meal. Organised Apiculture in addition to adding to his income is one of the best ways of meeting this end.

IV. SCOPE OF RESEARCH ON APICULTURE IN INDIA.

Scientific work is the backbone of any industry. Any organised attempt in introducing Apiculture in the villages could be possible only after acquiring sufficient scientific information about it. Haphazard

rushing in is bound to be a failure. Even if it will be successful temporarily, before long, the industry will come to a stand-still and progress will be impossible. In all advanced countries this is sufficiently recognised and Apiculture would not have come to its present flourishing condition but for the arduous labour of those engaged in research. The following five paragraphs deal with the absolutely minimum information required before advocating Apiculture in any locality.

V. LINES OF INVESTIGATION.

A.—*Bionomics.*

(1) *Life History.*—Our knowledge of the life history of *Apis indica* is fragmentary. A detailed all-round investigation on the life history and bionomics is therefore essential. Investigation into the longevity of the worker and the queen, the fecundity of the queen and the factors affecting swarming have direct bearing on the economics of Apiculture. The prevailing impression is that the worker of the Indian bee does not live as long as that of mellifica. A similar opinion is current regarding the fecundity of the queen of the former. Under domestication and culture the quality of bees is likely to improve and for a proper appreciation of the changes which will manifest as a result of culture, a thorough knowledge of the existing conditions is essential. A grasp of the bionomics will lead to ways and means of extending the longevity of the workers and possibly the fecundity of the queen.

The phenomenon of swarming also requires careful investigation. The swarming tendency is somewhat bred out of the Italian bee. The Indian bee is still primitive and is a slave to that instinct to a remarkable degree. Swarming is essential for the propagation of colonies but to the bee keeper it amounts to a nuisance, when as a result of successive swarming fairly strong colonies dwindle into handfuls of bees. The Apiculturist's work is both extensive as well as intensive. Swarming is a serious handicap to intensive culture. During the season a fairly strong colony of the Indian bee sends out as many as six swarms, the interval between two successive swarms being not more than ten days.

One of the methods at present practised to prevent swarming is the removal of queen cells. This is a difficult task as bees resent this operation very much and sting badly at the time. An easier method advocated is the use of reversible frames. This may not assure great success though it acts quite a palliative, as suitable locations will not then be available for erecting queen cells. Crowding is said to react on the bees in such a way as to send out a swarm. Provision of more space at the time is said to prevent swarming. How to bring out more space is a problem which requires some attention. A proper understanding of the different issues concerned in this mysterious response to an instinct will eventually lead to the solution of this knotty problem.

(2) *The Hive.*—Workers are divided in their opinion as to the size of the hive suitable to the Indian bee. The Pusa Bulletin advocates a hive as big as a kerosene box. The experience at Coimbatore is that a smaller hive is more suitable and that a fairly big one is one of the causes of desertion. Further, a big hive may have some frames unoccupied and may lead to wax moth attack. The Mysore Department of Agriculture adopts a hive intermediate in size between Coimbatore and Pusa patterns.

The Y. M. C. A., Coimbatore, has one of Gosh pattern hives which house a fairly big colony and apparently there is nothing wrong so far. In the face of such varied experience it is essential that systematic study of the size of hives should be undertaken. Probably the size of the hive should vary with localities, and local conditions, such as weather, availability of food, etc., will determine the size required for that locality.

(3) *Pasturage*.—Very little is known about the pasturage of the Indian bee. In itself it forms a fairly big field for study. Sometimes they seem to collect honey from all kinds of flowers. At other times they restrict themselves to a few. The mango flower produces honey, in fairly large quantities, but the bees do not care for the honey, though they go to the extent of collecting the honey from the mango hopper, a Jassid bug which attacks mango flowers. Statistics of bee pasturage and the comparative honey yield of different flowers, and the relative preference shown to them by bees require thorough investigation before maximum honey yield could be obtained from any particular locality. When this study is completed it will be possible to know with fair accuracy the honey flow from different flowering crops and after the main flow is exhausted, the resources from other flowers, if available, in other sites could be tapped. In this way a scheme of rotation could be worked out for all localities. For example, round about Coimbatore the cotton season is from January to April. The pasturage after this time will be sparse for about three or four months. The tamarind, another good yielder, flowers in April but it occurs only in isolated places and the hives of the Government Entomologist are therefore shifted to suitable sites where the tamarind will be available. Pongamia plants flower at Dharwar after the cotton season and will easily be a second pasture for bees. The same story holds good for pollen also. A full scheme of rotation if worked out for particular localities will simplify bee-keeping to a great extent. We cannot expect the Indian ryot to undertake such a study and many years will elapse before he attains that standard.

(4) *Seasonal variation in honey flow and yield*.—Coupled with the above study, a daily record of the weight of the hive and the temperature will be very illuminating. The weight of the hive is an index to its prosperity. The bees' response to the seasons will be clearly indicated in this record. The effect of artificial feeding when food supply is scarce will also be reflected in this record. Bees die in large numbers during the monsoon time. The temperature readings will throw some light on this fatality during the months of the monsoon. It will be premature to foretell how this study will be of importance in understanding clearly the domestic happenings and thereby to assess the prosperity of the colony, but we hope that when sufficient facts are gathered, they will facilitate working out the economics of bee-keeping.

(5) *Suitable localities*.—One of the foremost things in starting Apiculture is to select suitable localities which will form the venue of operations. Bees require both honey and pollen and the localities selected should provide both. Our experience is that bees collect honey from a host of plants, the more important of them are Cotton, Plantain, Tamarind, Pongamia, Coeanut, etc. The more important pollen supplying plants are the graminaceous plants like Zea mays, Andropogon Sorghum, Pennisetum typhoideum and also Cocos nucifera, Ricinus communis, etc. Pasturage is one of the aspects of bee-keeping in India which

invites thorough investigation and till fuller data is available such sites as will provide a fair amount of honey and pollen should be selected for starting the experiments. Experience in this direction will tell us which tracts will be suitable for Apiculture and which tracts not.

B—Breeding and Culture.

It is usually understood that the European bee is a superior honey gatherer and breeder on account of its bigger size. The European bee does not appear to be very successful in India. It is therefore worth while attempting to evolve a hybrid between the Indian and the European or Italian bee so as to combine the good qualities of both. This work requires a good deal of skill in technique and could be attempted only after acquiring a sound knowledge and experience in bee-keeping as well as in the bionomics of both those species. It will therefore be too early to dilate at any length on this aspect of the programme at this stage. Experiment in Apiculture in Egypt shows that the Egyptian bastard, a cross between Egyptian and Italian bees, does very well in that country. Provision for the purchase of Egyptian and Italian swarms and queens is included in the proposed expenditure of the year 1935-36.

There are two varieties of the Indian bee, a dark and a light one. The dark one inhabits usually the higher altitude whereas the light variety is prevalent in the plains. It is reported that the darker variety is a better honey yielder. This has to be verified. By persistent selection and improved cultural methods, it will be possible to increase the efficiency of our bees. Every effort should be made to improve the bees in this direction and after sufficient work is done, strains of bees (light or dark variety) will be available for distribution amongst the cultivators.

C—Introduction of foreign plants as pasturage to test if bee-keeping will be remunerative on a commercial scale.

Three foreign crops which are likely to prove promising in Apiculture are Buckwheat, Corean Lespezeda and White Clover. The honey yielding quality of these plants is well known. They are also valuable either as grain or as fodder. The second of these, the Corean Lespezeda, is a xerophyte and can stand even severe droughts. Apart from an Apicultural standpoint the introduction of this plant is likely to prove beneficial in the Deccan where rainfall is limited. The first two plants are at present cultivated at the Rural Reconstruction Centre, Vadala Mission, Ahmednagar District (American Marathi Mission) and appear to be suitable for our soil. It is proposed that these three plants should be tried as honey yielders. The information gained will show how far it is going to be a paying concern to cultivate these plants for purposes of Apiculture. For this purpose each crop should be cultivated on areas not less than two acres. To ensure a standing crop of two acres under each crop, allowing sufficient rotation of crops, the minimum land required will be ten acres. A suitable piece of land about ten acres in extent is available, to be taken on lease or rent, near the Vadala Mission. The owner demands a rent of Rs. 100 per annum. It is a suitable piece of land. There are three wells which will be sufficient to meet the irrigation requirements. The proximity to the Agricultural Station enables to hire cattle, implements and labour from the Station. The Principal of the Vocational School at the Rural Reconstruction Centre has very kindly consented to render all facilities in this connection.

VI. SCHEME.

The Scheme as outlined deals only with the preliminary aspect of Apicultural Research. The lines of investigation chalked out are only those of economic importance. The more difficult problems and those of purely academic interest have been left out, as they have to be undertaken only after sufficient ground is covered.

The proposed research will be conducted at three Stations, one located at Dharwar, a second at Vadala and a third at Mahim. Dharwar has been selected as it is typical of the Cotton and Juar tracts of the Deccan. Mahim has been selected as it possesses a vegetation of Coconut, Banana, etc., typical of the coastal tracts of the Presidency. Vadala is a centre of rural reconstruction work and on account of the facilities it offers in the cultivation of the foreign pasturage plants, it will be an ideal centre to concentrate on the commercial aspect of Apiculture. There is an additional attraction in the free service offered by Mr. Balaram, Vice-Principal of the Vocational School. Mr. Balaram is in charge of the Apiary at the Station and a certain amount of work on the practicability of Apiculture has already been attempted there. Any improvements carried out at that Station will be easily appreciated by the ryots of the surrounding areas and in this respect offers unique opportunities for propaganda in the event the investigation becomes fruitful.

Though regarding certain aspects the three Stations will work on common ground, it is proposed that each Station should concentrate on a few specific aspects of the Scheme. The Mahim Station, apart from studying pasturage, swarming, etc., will devote special attention to the bionomics, life history and the size and nature of the hives. The Vadala Station will attempt hybridization with Italian and Egyptian bee and on the honey yielding qualities of the foreign crops, and thereby work out the commercial aspect of the same. The Dharwar Station will see how far the Cotton tracts will be useful in honey production and devote more attention to the suitability of the Egyptian bastard to our conditions. It will make a thorough survey of the pasturage of Deccan.

The Director of Agriculture, Bombay, has been so kind as to grant permission to open the Dharwar Station on the premises of the Cotton Research Station. He has also promised the co-operation and assistance of the officers connected with the Station. As Dharwar has only low rainfall the hives could be located under the shade of the trees on the Station and from experience I find that it is better than placing them under a roof. A small store room will have to be rented on the premises from the Public Works Department. The Deputy Director of Agriculture, Dharwar, informs me that the rent will not exceed Rs. 4-2-0 per mensem.

The Station at Dharwar should be placed in charge of an Assistant who should be a Biology graduate with experience in handling bees. There should be an Attender to assist him. The pay proposed for the Assistant to be posted at Dharwar is in the scale of Rs. 100—10—200 and for the Attender at Dharwar Rs. 25 per month.

The Vadala Station will be in charge of Mr. Benjamin Balaram. He should be assisted by an Attender on Rs. 25 and a gardener and a servant boy on Rs. 10 and Rs. 5 per month respectively. A room for work and

for keeping the equipments will have to be rented out from the Agricultural Station for a rental of Rs. 50 per annum. The Principal has promised all possible assistance in working out the Scheme.

The Mahim Station will be directly in my charge and will be in a private garden where facilities for keeping the hives and the equipment could be rented out. There should be an Attender to assist me on Rs. 40 per month.

The number of hives at the Mahim Station should be, to begin with, nine--six of the Indian bee and three of the Egyptian bee. The Vadala Station should have fifteen hives of the Indian bee, five of the Italian and five of the Egyptian bee. The Dharwar Station should have fifteen hives of the Indian bee and five of the Egyptian bee. In the succeeding years the hives will increase in number on account of swarming. Spare hives will have to be purchased every year from the allotment under contingencies.

VII. STATEMENT OF ESTIMATED EXPENDITURE.

The following is a statement of proposed expenditure :—

	For five years. Rs.
<i>Recurring—</i>	
<i>Salaries—</i>	
Assistant at Dharwar in the grade Rs. 100—10—200 per mensem	7,200
Attender at Dharwar on Rs. 25 per month	1,500
Attender at Vadala on Rs. 25 per month	1,500
Gardener and Servant boy at Vadala on Rs. 10 and Rs. 5 per mensem	900
Attender at Mahim on Rs. 40 per month	2,400
Total of salaries	<u>13,500</u>

Rs. A. P.

Travelling allowance—

For the Officer in charge of the Station—

From Bombay to Ahmednagar and back :

Railway fare $1\frac{1}{2}$ second class, i.e., $1\frac{1}{2} \times$
Rs. 26 39 0 0

Mileage from Ahmednagar to Vadala and back at 4 annas per mile, i.e., 27 miles and 27 miles = 54 miles $\times 4 = 216$ annas, i.e. 13 8 0

Per trip 52 8 0

In round figures per trip Rs. 53.

For five years.
Rs. A. P.

Recurring—contd.

Travelling allowance—contd.

For five trips in the year Rs. 53 × 5 ..	265	0	0	
From Bombay to Dharwar and back :				
Railway fare 1½ second class, i.e., 1½ × Rs. 56 = Rs. 84-0-0.				
For five trips in the year Rs. 84 × 5 ..	420	0	0	
Halting allowance for visiting these Stations 40 days in the year at Rs. 3-8-0 per day, i.e., 40 × Rs. 3-8-0 ..	140	0	0	
Daily allowance for visiting the Mahim Station 90 days in the year at Rs. 3-8-0 per day, i.e., 90 × Rs. 3-8-0 ..	315	0	0	
(Mahim is 10 miles from Bombay.)				
Total travelling allowance for the Officer in charge per year ..	1,140	0	0	5,700
For the Officer in charge at Vadala—				
Visit to Dharwar Station once a year :				
Railway fare from Ahmednagar to Dharwar and back 1½ second class, i.e., 1½ × Rs. 56 ..	84	0	0	
Mileage from Vadala to Ahmednagar and back at 4 annas a mile—56 miles ..	13	8	0	
Halting allowance for 4 days at Rs. 3-8-0 ..	14	0	0	
Total travelling allowance for the Officer at Vadala per year (in round figures) ..	112	0	0	560
Total of travelling allowance ..				6,260

Contingencies—

For Dharwar—

Rent for Station per annum ..	50		
Other incidental expenses including purchase of spare hives, small apparatus, stationery, correspondence, etc. ..	150		
Total per year ..	200		1,000

For Vadala—

Cultivation expenses including purchase of seeds, irrigation, ploughing, etc., per annum ..	200		
Rent for 10 acres of land ..	100		
Rent for laboratory ..	50		
Other incidental expenses including purchase of spare hives, stools, correspondence, etc. ..	150		
Total per year ..	500		2,500

		For five years.	
<i>Contingencies—contd.</i>		Rs.	Rs.
For Mahim—			
Rent for the Station per annum	..	84	
Other incidental expenses	..	100	
		<hr/>	<hr/>
Total per year	..	184	920
		<hr/>	<hr/>
Total of recurring contingencies	..		4,420
<i>Non-recurring—</i>			
Purchase of Indian bees—			
For Dharwar	.. 15 hives		
For Vadala	.. 15 hives		
For Mahim	.. 6 hives		
			Rs.
at Rs. 20 per hive for 36 hives	..	..	720
Transport charges for the hives from Coimbatore or Travancore or both	..	..	200
Purchase of Italian bees—5 swarms for Vadala with spare Queens and transport charges at Rs. 150	..	..	750
Purchase of Egyptian bees—			
For Dharwar	.. 5 swarms		
For Vadala	.. 5 swarms		
For Mahim	.. 3 swarms		
	13 swarms		
with spare Queens and transport charges at Rs. 150	..	..	1,950
			<hr/>
Total for purchase of bees	..		3,620
			<hr/>
Purchase of apparatus and equipment—			
Shed at Vadala honey extractors, thermometers, etc., for three Stations	..	..	570
Binoocular microscope for the Vadala Station	..	..	500
Apparatus for insemination	..	..	200
			<hr/>
Total for apparatus and equipment	..	..	1,270
			<hr/>
Grand total for five years	..	..	29,070
			<hr/>

Year.	Recurring.			Non-recurring.
	Salaries.	Travelling allowance.	Contingencies.	Contingencies.
	Rs.	Rs.	Rs.	Rs.
1934-35	2,460	1,252	884	4,890
1935-36	2,580	1,252	884	..
1936-37	2,700	1,252	884	..
1937-38	2,820	1,252	884	..
1938-39	2,940	1,252	884	..
Total for five years ..	13,500	6,260	4,420	4,890
Grand total for five years ..	..	..	Rs. 29,070	..

VIII. INCOME AND ASSETS AT THE CONCLUSION OF THE RESEARCH.

	Rs.
There will be an income from land at Vadala at least Rs. 100 per annum—for five years	500
The income from the sale of honey of the Indian bee on a modest estimate of 4 lbs. of honey per hive at Re. 1 per lb. is expected to be for the 1st year Rs. 140 ; 2nd year Rs. 280 ; 3rd year Rs. 420 ; 4th year Rs. 560 ; and 5th year Rs. 700 ; i.e.	2,100
The yield from foreign bees is not taken into account at all.	
Total income	2,600

On the conclusion of the research the assets of the Stations is expected to be at least 500 hives of the Indian bee worth Rs. 10,000 and if everything goes well with the foreign bees there will be left of them 250 hives worth Rs. 37,500. If the hybridization experiments are going to be successful the hybrids will be worth double the value of the foreign bees, i.e., Rs. 300 per hive.

	For five years.
	Rs.
Even if the Italian or the Egyptian bee does not thrive satisfactorily and the hybridization attempts prove to be failure there will be at least 100 hives left of these foreign bees and estimating at a low figure of Rs. 100 per hive their value will be Rs. 10,000. The total value of Indian and foreign bees will therefore be at least	20,000
The value of the equipment at half the invested amount will be at least	1,000
Total assets	21,000
The income <i>plus</i> the assets at the conclusion	23,600

The net expenditure which has to be incurred by the Council will be less than Rs. 6,000.

ANNEXURE II.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, BARODA STATE, BARODA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, S.-W., No. 5906 OF 1933-34, DATED THE 26TH JUNE 1934.

I have the honour to send by a separate registered book post 200 printed copies of the Bee-keeping scheme to be submitted to the Imperial Council of Agricultural Research at the ensuing Advisory Board Meeting to be held in September, 1934, for your perusal and circulation to the members. One printed copy is enclosed herewith for perusal.

SCHEME FOR RESEARCH ON BEE-KEEPING FOR GUJERAT.

GENERAL.

Bee-keeping is one of the Agricultural Industries that have received scant attention from the public and its possibilities to provide a source of earning during spare time do not seem to have been considered seriously. The importance of honey as a valuable item of food is growing day by day, and establishing of bee-keeping as an industry by itself will surely form a very valuable measure in increasing national wealth and indigenous agricultural activities. It is also surmised that very large quantities of honey are imported from foreign countries and it is of immediate importance to take very active steps in the establishment of this industry.

Bee-keeping is well-known to be very successful to supplement the cultivator's normal income. That any measure designed to investigate into possibilities of successful bee-keeping is of an all India importance cannot be denied and it is on the following lines that information is lacking and on which research work has to be undertaken.

The manipulation of Indian bee including hive designs and trials with various local races—the Indian bee (*Apis indica*) is not considered as a comparatively good honey gatherer—from about 30 to 40 lbs. of honey in the hills to about 6 to 10 lbs. honey in plains. A colony of Indian bees yield varying quantities of honey per annum and information is lacking as to the factors that influence these variations and whether the present methods of manipulation and the designs of the hives require changes to secure a better yield. Criticisms as to the unsuitability of the Indian bee are often levelled and it is to be regretted that no full knowledge of the characteristics of local races are yet available.

Hybridisation with local races and varieties with a view to secure a strain of higher honey yielding capacity and less swarming impulse—it is often expressed that the Indian bee has the most swarming impulse. Over a dozen reasons may be put forward to explain the incidence of this impulse, but no experiments have been undertaken to practise preventive measures. Various races of bees possess varying degrees of this impulse and possibilities of hybridizing these races to secure a strain with less of this impulse have to be investigated. The rock-bee for instance is reputed to be a good gatherer and possibilities of hybridizing it with the Indian bee also require to be investigated on. With the present information, a definite opinion as to the sources of this venture can not be given and if the work proves successful a very great impetus can be given to the starting of large scale apiaries all over India.

Trial of local races in various surroundings having variations in pasturage with a view to ascertain the limiting factors to success—bee-keeping in climatic, seasonal and pasturage conditions is of importance. The information available at present as to what plants are useful as bee-pasturage in India and how the availability or otherwise as such plants will stand as a limiting factor for bee-keeping as commercial proposition is so scanty that it is not possible to ascertain whether in a given locality bee-keeping will at all be successful. So also climatic and seasonal factors that influence honey gathering require to be carefully studied.

Costing experiments with cultivated pasturage and honey yield to see if the former could be profitably carried out in localities where there is a lack of natural pasturage or where there is only one flowering season—in certain localities on account of incidence of one monsoon, there exists only one flowering season and bees suffer from lack of pasturage during the rest of the year. Experiments need be conducted on the economics of certain plants whose flowers serve as good bee pasturage during the season of drought.

A fuller knowledge of the seasonal factors that influence breeding, swarming and honey gathering—it is often mentioned that swarming just precedes the honey flow and swarming is preceded by breeding. Fuller information is necessary with regard to the seasonal factors that influence breeding.

EFFORTS OF BARODA GOVERNMENT :

The Department of Agriculture of the Baroda Government has started Bee-keeping since the last four years by the introduction of bees from Coimbatore. Efforts on the line were made at the Baroda Agricultural Experimental Station and subsequently when the Rural Reconstruction work was started at Kosamba this work was handed over to that section on which the Baroda Government are spending about Rs. 20,000 per year. Local bees (*Apis indica*) are available from Baroda territory and if the local bees are experimented with, the difficulties as to double swarming, different pasturage, etc., which have been experienced might be easily dealt with. The problem of combating the deadly pest of wax moth faced gravely the problem in Baroda and this as well might be attended to. The Officer in charge of the Rural Uplift Scheme is an Expert Bee-keeper but for want of different duties he has to attend to, he could not solely give his attention to this item and a special staff for such research may help him a lot on the line.

MAIN ITEMS OF RESEARCH :

The main items of research in this Bee-keeping which ultimately may be useful for Gujarat and other like parts are (1) Collection of local bees and studying their behaviour, manners, etc. (2) Crossing of these bees with other types in order to improve their desirable qualities, (3) Study of pasturage—artificial and natural and lastly, (4) The Study and control of bee diseases and pests.

THE SCHEME :

The Baroda Government will provide all the apparatus and material for the purpose and the Expert staff may be provided by the Imperial Council of Agricultural Research. This staff will work under the Rural Reconstruction Officer.

The following may be the establishment and other charges for the Scheme to be spread over a period of five years :—

RECURRING EXPENDITURE :

—	I.	II.	III.	IV.	V.	On an average.
1. A Bee-expert (150—15—225) ..	1,800	1,980	2,160	2,340	2,520	2,160
2. A non-graduate or graduate assistant (50—5—75).	600	660	720	780	840	720
3. Travelling expenses	500	500	500	500	500	500
	2,900	3,140	3,380	3,620	3,860	3,380
Total Rs. 16,920						

Non-recurring expenditure such as Office dead-stock, management, apparatus, appliances, etc., might be arranged through the Agricultural Department of the State.

Average pay may be allowed to suitable persons if necessary.

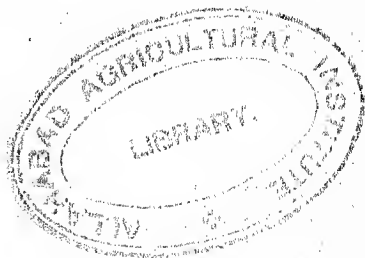
ANNEXURE III.

Extract from the proceedings of the Advisory Board, January 1931.

“ Dr. Keen in introducing the scheme said that if it was desired to develop bee-keeping in India the way suggested in the scheme of the Imperial Entomologist was the way to do it, but Dr. Keen had no knowledge of the demand in the country and he thought that the Board should be guided in this matter by the views of representatives of the provinces. He also thought that it would be very difficult to get the right type of man to take charge of this scheme. Dr. Hyder supported the scheme on the ground that it might lead, if successful, to the establishment of a cottage industry in India. The Royal Commission on Agriculture had stressed the importance of the development of cottage industries in India. Professor Agharkar said that he was diffident about the scheme as outlined. He saw that Rs. 20,000 per annum had been provided on account of the cost of the officer and Rs. 10,000 for other items of expenditure and he considered the total cost excessive. He was also not in favour of appointing the expert from abroad who would go away after three years with all the accumulated knowledge gathered by him which would be lost to India. If there was scope for the development of bee-keeping in India he thought a better course would be to send a promising student abroad with a scholarship who on his return could tackle with the subject. Mr. Plymmer said that bee-keeping was not a matter of general importance in India and he was therefore not particularly keen on this scheme. He thought that the problem of bee-breeding should be one of the problems which should be referred for investigation to Universities with the help of a small grant. Mr. Collins said that he thought the

scheme was too expensive. The bee-industry in India was not likely to become a cottage industry in the plains owing to climatic conditions. Flowers grew in India all the year round and there was therefore no incentive such as they had in colder climates for bees in India to store their honey except in very limited areas. If, however, it was desired to investigate the question he would suggest either, as Dr. Agharkar had proposed, to send a student from India with a scholarship abroad or, as Mr. Plymen had recommended to add it to the list of problems which would be referred to Universities for a grant. Mr. Burt said that the economic problem should be kept separate from the technical. He did not think that on present information there was sufficient justification for the view advanced by Mr. Collins that India was not a suitable place for bee-keeping. It might be that if the right type of bee was obtained a cottage industry might be established. The question which they had to decide was whether bee-keeping was worth while. If the answer was in the affirmative then he would support the adoption of Dr. Agharkar's proposal to send a student abroad with a scholarship for training instead of importing an expert from abroad. Mr. Carpenter in opposing the whole scheme said that its annual cost was Rs. 30,000. The Board had been informed that for this amount three Animal Nutrition Sections could be run in the provinces. There was no question as to the relative importance of the two. This was only an example. In his opinion there were many much more important problems both in agriculture and animal husbandry than bee-keeping to which the Council could profitably devote its funds.

The Board did not recommend the scheme for sanction ''.



APPENDIX X.

NOTE, DATED THE 3RD AUGUST 1934, ON SUBJECT NO. 20, PROCEEDINGS OF THE SECOND MEETING OF THE STANDING ANIMAL NUTRITION COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD IN FEBRUARY 1934.

Attention is invited to the copy of the proceedings (not printed) of the Standing Animal Nutrition Committee of the Imperial Council of Agricultural Research. The recommendations of the Committee have been tabulated in the enclosed statement (Annexure) and they are now for the consideration of the Advisory Board.

ANNEXURE.
Recommendations of the second meeting of the Standing Animal Nutrition Committee.

Serial No.	Subject.	Resolutions of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Committee.
1	To discuss the economic importance of the degeneracy caused in livestock of all kinds in India by insidious disease due to parasitic invasion of the blood and other tissues and by nutritional defects, and to suggest practicable methods for dealing with it. (Subject No. 16 of the Agenda of the Animal Husbandry Wing of the Board of Agriculture).	The effect of nutritional factor in the causation of disease and degeneracy among livestock in India require thorough investigation.	The work now done being by disease Investigation Officers is likely to be of the greatest value in the prosecution of animal nutrition research and recommended that with a view to their investigation from nutritional point of view, Directors of Veterinary Services should be asked to forward brief special notes to the Animal Husbandry Expert, as early as possible, of any cases of cattle disease apparently due to nutritional defects in particular localities.
2	To consider the position of research into equine nutrition in India, including the systematic investigation of the composition of available fodders and the necessity for devising practicable methods of improving grazing areas and the quality of hay produced under Indian condition. (Subject No. 21 of the Agenda of the Animal Husbandry Wing of the Board of Agriculture.)	The Board considers that for the improvement in the quality of grazing areas, rotational grazing is the best procedure and silage making is recommended as a method of conserving any excess grown.	<p>In regard to the general question of the relation of animal nutrition to disease they consider that the time is not yet ripe for the preparation of a definite scheme of research but recommend that the matter be brought up again at the next meeting of the Committee for discussion in relation to the work in progress at various institutions.</p> <p>Research work on the nutritional aspect of silage was already in progress and that no further action was at present necessary on this recommendation.</p>

Serial No.	Subject.	Resolutions of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Committee.
3	The need of respiration work in connection with animal nutrition research in India. (Subject No. 22 of the Agenda of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.)	<p>The Board considers that respiration work on animals is of fundamental importance in obtaining knowledge as to how the animal treats the final products of digestion of its ration. In other words, it is essential for obtaining the complete picture of the nutritive value of any foodstuff.</p>	<p>The Committee reiterates that respiration work is essential for the proper study of animal nutrition in India and that for this reason a properly equipped Central Animal Nutrition Research Institute is most urgently required.</p>
4	Minerals in Indian pastures and fodders and the mineral requirements of stock. (Subject No. 23 of the Agenda of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.)	<p>Resolved that systematic work should be started on the analysis of the mineral content of food and foodstuffs. In order to ensure uniformity of procedure the Board recommends that Dr. Lander should be requested to prepare a scheme of work in consultation with the Provinces in regard to the procedure to be employed, and emphasises that an investigation on the mineral requirements of daily cattle is of outstanding importance to India.</p>	<p>In order to ensure uniformity of procedure in the analyses of the mineral content of foodstuffs, it was agreed that Dr. Lander should be asked to submit to the Animal Husbandry Expert, for criticism by the departments concerned, a note on the procedure recommended for mineral analyses and the analytical methods employed.</p>
5	The importance of blood analysis in animal nutrition work. (Subject No. 24 of the Agenda of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.)	<p>The Board considers that :</p> <ol style="list-style-type: none"> 1. The work which Mr. Warth proposed to carry out at Bangalore on blood analysis is of great economic importance and its prosecution should be encouraged. 2. The Imperial Institute of Veterinary Research, Muktesar and the Physiological Chemist Section of the Imperial Institute of Agricultural Research at Bangalore should collaborate in this work. 	<p>Dr. Sen visited the Physiological Chemist's Section at Bangalore for the purpose of acquainting himself with progress there and of establishing co ordination with Dr. Warth.</p>

6 To make suggestions for the better organization of Animal Nutrition research in India and to consider what action should be taken for the establishment of a Central Nutrition Institute in India. (Subject No. 2 of the Agenda of the Committee.)

....

For the better organisation and co-ordination of animal nutrition and allied research Local Governments and the Departments of Government of India concerned be asked to permit workers on animal nutrition and allied research to submit to the Animal Husbandry Expert at the earliest possible date, advance copies of their annual reports, for consideration by the Standing Animal Nutrition Committee and to give facilities for this Committee to meet periodically at the institutes at which such work is carried on. It was felt that in this way a great deal could be done to stimulate and co-ordinate such work but the Committee consider that a properly equipped Central Animal Nutrition Research Institute is essential. It was agreed that it was not practicable to establish such an institute at the present Imperial Institute of Animal Husbandry and Dairying, Bangalore, and in order to facilitate the creation of such an institute elsewhere it was agreed that Dr. Lander should be asked to submit a statement, for criticism, showing the minimum requirements of a properly equipped Animal Nutrition Research Institute, giving details of the laboratory buildings, equipment and facilities required, with a rough estimate of their probable cost.

7 To consider the feasibility of carrying out Animal Nutrition Research at the Allahabad Agricultural Institute in conjunction with the Allahabad University. (Subject No. 3 of the Agenda of the Committee.)

....

Mr. Warth should get in touch with Dr. Schneider to ascertain exactly what facilities he would have at his disposal for carrying out such work so as to be in a position to advise as to what research work could be usefully taken up at this Institute.

APPENDIX XI.

NOTE, DATED THE 11TH AUGUST 1934, ON SUBJECT No. 21, PROCEEDINGS OF THE FIRST MEETING OF THE STANDING DAIRYING COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD AT NEW DELHI IN MARCH 1934.

Attention is invited to the copy of the proceedings* of the Standing Dairying Committee of the Imperial Council of Agricultural Research. (This may be treated as confidential.) The recommendations of the Committee have been tabulated in the enclosed statement (Annexure) and they are now for the consideration of the Advisory Board.

8. With reference to the recommendation of the Committee regarding the establishment of an institute of dairying at Bangalore (item No. 2 of Annexure) it may be noted that a scheme has already been drawn up by the Animal Husbandry Expert to the Council in consultation with Imperial Dairy Expert and it is now under the consideration of the Government of India.

*Not printed.

ANNEXURE.

Action taken on the recommendations of the first meeting of the Standing Dairying Committee of the I. C. A. R.

Serial No.	Subject.	Resolutions of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Standing Dairying Committee.
1	To consider the figures obtained from the Military Dairy Farms regarding the comparative efficiency of Indian cattle, cross bred cattle, and buffaloes as milk and butter-fat producers under Indian conditions in relation to the present and future requirements of dairying in India. (Subject No. 15 of the A. H. W.)	<p>1. The statistical investigation of the comparative economic efficiency of the various types of milch cattle in India already undertaken by the I. C. A. R. should be continued.</p> <p>2. The investigation so far conducted should be published after further statistical analysis.</p> <p>For the protection of health and for the development of the dairy industry all legislation for the prevention of adulteration of dairy products should be made obligatory on local bodies and not optional.</p> <p>In order to develop the dairy industry of India on scientific lines it is necessary to have a much enlarged central institute at which, in addition to the training of students, more extensive research and investigation of the problems of practical dairying in India could be carried out.</p>	The results so far collected should be published without any further statistical analysis and that the collection of data in regard to buffaloes in villages should be started.
2	To discuss the practicability of developing dairying as a village industry in India along with the organized marketing of eggs and other animal products. (Subject No. 18 of the A. H. W.)	<p>For the protection of health and for the development of the dairy industry all legislation for the prevention of adulteration of dairy products should be made obligatory on local bodies and not optional.</p> <p>In order to develop the dairy industry of India on scientific lines it is necessary to have a much enlarged central institute at which, in addition to the training of students, more extensive research and investigation of the problems of practical dairying in India could be carried out.</p>	<p>A Sub-Committee consisting of Colonel Olver and Mr. Kothawala should be appointed to draw up a detailed scheme for the establishment of an institute of dairying at Bangalore including the question of acquiring more land that might be considered necessary, the staff that might be required etc., etc., the Sub-Committee to report to this Committee when the matter would be further considered.</p>

Serial No.	Subject.	Resolutions of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Standing Dairy- ing Committee.
3	To discuss Messrs. Polson Manufacturing Company's letter regarding private trading by the Military Dairy Farms. (Item 2 on the agenda of the Committee.)	....	Major Pender promised to supply figures to refute the statement that the Military Dairies are increasing their operations. Record of discussion be sent to the Army Department for favour of their views confidentially.
4	To consider what action should be taken on the letter from Messrs. Polson Manufacturing Company, dated the 5th June 1933 and the representation made by the Bombay Butter Manufacturers' Association which were discussed at a meeting between their representatives and the Vice-Chairman, Imperial Council of Agricultural Research in Bombay on 31st August 1933. (Item 3 on the agenda of the Committee.)	....	Record of discussion to be sent to the Army Department for their views. 2. A protective duty should be imposed on the importation of butter from abroad.
5	To consider the question of railway rates on dairy produce and the facilities at present available for its transportation in cold storage or refrigerating vans. (Subject No. 6 of the agenda of the Committee.)	....	(1) In the interests of developing the industry the I. C. A. R. might undertake responsibility for any loss incurred in this connection provided that one or more firms would guarantee a minimum daily freight sufficient to cover most of the cost of running the insulated van. (2) To request the firms concerned to send a scheme to the I. C. A. R. on the subject giving the necessary details after making enquiries in the matter.

- (3) Record of the discussion be sent to the Railway Board for their remarks.
 (4) To present the case to the Railway Board regarding the reduction of railway rate on butter.

Mr. Kartha should prepare a note explaining clearly the object of each of the forms. The note should then be sent to the members of the Committee together with copies of forms to enable members to consider the matter and send their views to the Sectt. of the Council.

1. The I. C. A. R. be requested to give a grant of Rs. 5,000 to the Imperial Dairy Expert for propaganda for the "Drink More Milk" Campaign; this amount to be used by the Imperial Dairy Expert for issuing attractive posters, to obtain more films explaining the advantages of good dairy products, for equipment, etc.

2. The Council should offer three prizes for the preparation of posters, leaflets and text books on the advantages of drinking milk; the amounts of prizes to be fixed later.

3. The Government of India in the Education, Health and Lands Department be recommended to make a specific grant to the Imperial Dairy Expert of Rs. 3,000 to start with for propaganda purposes.

- 6 To discuss the possibility of instituting a uniform system of recording for dairy herds. (Subject No. 4 of the agenda of the Committee).

- 7 To consider suggestion for the development of propaganda and publicity among the general public to consume more milk. (Subject No. 5 of the Committee.)

Serial No.	Subject.	Resolutions of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Standing Dairy-ing Committee.
8	To discuss the question of exemption of dairy equipment from import duty. (Subject No. 7 of the Committee.)	....	The matter is under consideration in the Commerce Department.
9	To consider Mr. Kartha's resumé of his work at Lahore. (Subject No. 8 of the Committee.)	....	The work done by Mr. Kartha was essential and should be continued.
10	To discuss the question raised by Captain Lal Chand in the House regarding the possibility of returning dry cows from cities. (Subject No. 9 of the Committee.)	....	The only practicable and effective remedy for preventing the slaughter of milch cattle is for the big City Municipalities to prohibit the keeping of stables for milch animals in the Municipal area. Milch cows and buffaloes should be housed in rural areas outside the municipal areas. Copy of the discussion should be sent to Captain Lal Chand.

APPENDIX XII.

NOTE, DATED 20TH AUGUST 1934, ON SUBJECT No. 1, DECISIONS OF THE GOVERNING BODY ON THE RECOMMENDATIONS OF THE ADVISORY BOARD MADE AT THE LATTER'S MEETING HELD IN FEBRUARY 1934.

1. Extension of the Locust Research Scheme of the Imperial Council of Agricultural Research for a period of one year from 1st April 1934 at an estimated cost of Rs. 83,600 (in round figures).

—Sanctioned.

2. Grant of Rs. 1,695 to the Dacca University, Dacca, on account of apparatus, etc., for the year 1934-35 in connection with the scheme for work on (i) the mechanical analysis of lateritic soils and (ii) the nutrition of the rice plant.

—Sanctioned.

3. Participation of India in the Xth World's Dairy Congress, Rome-Milan, April-May 1934.

The Governing Body sanctioned the deputation of Mr. W. J. Hansen, Professor of Dairying and Animal Husbandry, Allahabad Agricultural Institute, and (ii) Mr. C. A. Maclean, Deputy Director of Agriculture, Bihar and Orissa, at a cost not exceeding Rs. 1,350.

4. Application from the Government of Bihar and Orissa for a grant of Rs. 6,000 spread over a period of 3 years, for a scheme of investigation on the possibilities of manufacturing *Khandsari* sugar by the single-pan method.

—Sanctioned.

5. Participation of India in the Annual Congress of the Royal Institute of Public Health, Norwich, May 1934.

The Governing Body sanctioned the deputation of (1) Mr. F. Ware, Director, Imperial Institute of Veterinary Research, Muktesar, and (2) Lt.-Col. Sokhey, Director, Haffkine Institute, Bombay, at a cost not exceeding Rs. 400. Lt.-Col. Sokhey did not however participate.

6. Contribution of a sum of Rs. 14,500 during the period 1st October 1933 to the 31st March 1934 towards (1) the maintenance of the Laboratory for collecting, breeding and despatching beneficial parasites at Farham House, and (2) the investigations into the control of insects and moulds injurious to stored products at Slough.

—Sanctioned.

The remaining recommendations of the Board will as usual come before the next meeting of the Governing Body.

APPENDIX XIII.

NOTE, DATED THE 6TH AUGUST, 1934, ON SUBJECT No. 3, PROCEEDINGS OF THE FIRST MEETING OF THE CATTLE BREEDING COMMITTEE APPOINTED BY THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

The proceedings (not printed) of the first meeting of the Cattle Breeding Committee held in February 1934 are circulated to the Members of the Advisory Board. The recommendations made by this Committee on the various items of the agenda have been summarised in the attached statement (Annexure).

2. The recommendations are now for the consideration of the Board.

ANNEXURE.

Recommendations of the Standing Cattle Breeding Committee of the Imperial Council of Agricultural Research.

Serial No.	Subject.	Resolution of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Cattle Breeding Committee.
1	<p><i>No. 10 of the Agenda of the Animal Husbandary Wing—</i></p> <p>To review the results so far achieved in the crossing of the indigenous breeds of cattle by foreign breeds in the different provinces and States and on Military Dairy Farms, and to consider its value in relation to the permanent improvement of livestock throughout India.</p>	<p>(1) The Board considers that the results hitherto achieved in the crossing of indigenous breeds of cattle with foreign breeds indicate that this system of improving livestock in India does not produce results of a permanent nature and is not suited to the ordinary conditions of the country.</p> <p>(2) The Board appreciates the excellent results achieved on military Dairy Farms but regards the methods used as special requirements and not therefore applicable to India as a means of bringing about a permanent improvement of indigenous cattle. As a result of this opinion the Board would express the wish that Military Dairy Farms should not dispose of any uncastrated European Cross-Bred bulls nor should they dispose of similar female stock unless previously immunised against rinderpest.</p>	<p>The only practicable way of dealing with this matter would be by means of compulsory castration and recommend that the recently passed Bombay Livestock Improvement Act as well as the action taken by the Punjab Government in this matter should be brought to the notice of other Provincial and State Governments with a strong recommendation that similar powers should be taken to enforce castration of unfit animals wherever possible.</p>

Serial No.	Subject.	Resolution of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Cattle Breeding Committee.
2	<p><i>No. 11 of the Agenda of the Animal Husbandry Wing—</i></p> <p>To consider whether pedigree Herd Books in the case of a few selected breeds can now be established for the lasting improvement of these breeds, particularly in regard to the development of dairy strains.</p> <p><i>Nos. 2 and 4 on the Agenda of the Cattle Breeding Committee—</i></p> <p>To discuss the future policy as regards the development of definite dairy strains from existing working breeds.</p>	<p>The Board considers that all-India pedigree herd books can now be established in the case of a few well-known dairy breeds, commencing with the breeds at present maintained on Government Farms and other Institutions where reliable records are kept. In the case of other breeds it recommends that provincial herd-registration, with the object of emphasising the value of pure bred animals, should precede the more detailed individual records usually included under pedigree. The procedure adopted in the Bombay Presidency is recommended as a guide in this direction.</p>	<p>A system of registering and marking improved cattle, similar to that adopted in the Bombay Presidency and to some extent in the Punjab, should be generally adopted in India to enhance the market value of carefully bred stock produced by breeders in the country. The first step in establishing all-India pedigree records would be to carry out an all-India survey to decide (a) which of the so-called breeds at present in existence are valid breeds and worthy of organised development and (b) to decide on an official definition of the breed characteristics of each breed which it is proposed to recognise.</p> <p>The Animal Husbandry Expert to the Council be requested to put up a scheme for this work to be undertaken under a grant from the Imperial Council of Agricultural Research.</p>

To consider what preliminary steps are necessary in regard to the institution of herd books for selected breeds of indigenous cattle.

No. 12—

To review the position as regards the methods hitherto adopted for encouraging the employment of improved sires including the systematic castration of scrub animals and to suggest practical means of extending them.

The Committee considered that in relation to the measures recommended for compulsory castration and the systematic registration and marking of approved cattle the attention of Local Governments should be drawn to the total inadequacy of the funds at present available for organized live-stock improvement work of this nature and to the necessity, in view of the importance of live-stock to the country of all District Boards allocating an adequate percentage of their incomes to such live-stock improvement work.

The Board considers that the methods adopted in various provinces and States for encouraging the use of suitable pure bred bulls all tend to produce the desired results and are only limited in their extent by financial considerations. They recommend that as in the Punjab, District Boards in other provinces should be empowered to provide funds for encouraging the use of suitable pure bred bulls and that the control of such funds should rest with the department controlling livestock improvement. As regards castration, the Board is of the opinion that the action taken in the Punjab, by the Local Government, empowering District Boards to frame regulations for the castration of scrub animals should be brought to the notice of other Governments.

No. 13—

To review the effects of abortion, sterility and impotence on breeding operations amongst domesticated animals in India and to discuss the best methods for diagnosing and controlling these conditions.

The Board considers that considerable losses occur in the live-stock industry from infectious and contagious diseases of the productive organs in both cattle and horses and that these are obviously important factors in the economy of herds and studs now maintained in this country. It is of the opinion that a very strong case has been made out for the early appointment of a special research officer to investigate these diseases.

The Imperial Council of Agricultural Research should obtain from Local Governments such information as is available as to the incidence and economic importance of contagious disease of the reproductive organs in all classes of farm live-stock throughout India.

Serial No.	Subject.	Resolution of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Cattle Breeding Committee.
5	<p><i>No. 14—</i> To discuss the position of sheep breeding in India and to suggest practical methods for improving the quantity and quality of wool produced.</p> <p><i>Item 3 on the Agenda of the Cattle Breeding Committee—</i> To discuss what further measures can be taken for the improvement of sheep and for the grading and marketing of wool.</p>	<p>The Board considers that—</p> <ol style="list-style-type: none"> 1. The problems of sheep breeding in hill tracts and in plains areas require separate treatment. 2. Sheep breeding is to a great extent in the hands of a nomadic class through whose agency any sustained efforts towards improvement will be difficult. It is therefore desirable that all local Governments should interest themselves directly in this question and thereby encourage the land-owning class to engage in this industry. 3. This can best be accomplished by the establishment in each province and State of selected flocks of the better indigenous breeds with the object of providing a nucleus of sufficient purity to render possible the resuscitation of each breed. 4. The Board welcomes further sustained experiments on Government Stock Farms in the crossing of Merinos and specially graded indigenous breeds and in this connection would command the scheme put forward by the Live-stock Expert of the Bombay Presidency to the Advisory Board. <p>On account of the indifferent methods at present adopted in shearing, classifying and marketing wool.</p>	<p>That with a view to developing the wool industry in India the Imperial Council of Agricultural Research should take up the official grading of wool at selected centres.</p>

sheep-owners in this country are not obtaining the full value of their wool. Efforts should therefore be made to remedy these defects by suitable demonstrations to be conducted by Live-stock Departments.

6. The Veterinary Departments should increase their efforts to deal with the problem of the very large mortality occurring amongst sheep, particularly that due to parasitic diseases, which are at present strangling this industry.

....

....

6 *Item 6 on the Agenda of the Cattle Breeding Committee—*

Finding ways and means of improving the local cattle of Coorg.

7 *Item 7 of the Agenda of the Committee—*

Report for the year 1932-33 on the scheme for breeding experiments in connection with the improvement of goats conducted by Mr. A. E. Slater.

The Animal Husbandry Expert should visit Coorg and consider what measures are feasible under existing conditions, so that the matter could be again dealt with by the Advisory Board.

The work is being carried on on satisfactory lines and is already leading to valuable results. The Committee wish to emphasise the importance of controlling Brucella infection and for this and other reasons consider that an adequate isolation ward is essential.

It appeared from the figures produced in the report that some of the goats had been kept in milk for unduly long periods and the Committee suggest that an effort should be made to determine the optimum length of a lactation period in each of the breeds dealt with and to milk their goats accordingly.

[The above recommendation was submitted to the Advisory Board at its meeting held in February 1934. Item No. 28 (i) of the Agenda.]

Serial No.	Subject.	Resolution of the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry.	Recommendations of the Cattle Breeding Committee.
8	<p><i>Item 5—</i> To consider the feasibility of testing young bulls and carrying out artificial insemination in this country and the desirability of stimulating young heifers to breed and produce milk at an early age by special methods.</p>	<p>....</p>	<p>Experimentation with such special measures to induce a high milk yield from Indian Dairy Cattle at an early age as have been adopted in the Fusa herd were at present justifiable only under strict control and that such methods could not be recommended for general adoption until the effects of such highly intensive treatment on constitution had been carefully studied. The Committee did not consider it feasible to carry out artificial insemination to any considerable extent in India in present circumstances but considered that experimentation in such work on existing Government farms would be desirable.</p>

APPENDIX XIV.

NOTE, DATED THE 20TH AUGUST, 1934, ON SUBJECT No. 5, FOURTH ANNUAL REPORT OF THE EXECUTIVE COUNCIL OF THE IMPERIAL AGRICULTURAL BUREAU, 1932-33.

Attention is invited to the attached copy (Not printed) of the Fourth Annual Report of the Executive Council of the Imperial Agricultural Bureaux, 1932-33. As members of the Board are already aware, the Imperial Council of Agricultural Research, as soon as it was formed, took over the liability of the Government of India in regard to contributions to Imperial and International institutions of this character. The Council pays an annual subscription of £2,187-10-0 to the whole group of Bureaux. The Agricultural and Animal Husbandry Expert Advisers to the Council are the official correspondents in India for the appropriate bureaux of which there are eight in number.

2. It will be seen from the Report (Not printed) that the gross expenditure in the year 1932-33 was £19,245-16-8. The difference, *viz.*, £1,079-13-6 between this and the net expenditure represents the receipts from sales of publications and journals.

An analysis of expenditure will be found in the statement given under paragraph 8 of the Report (Not printed) from which it will be seen that the 'overhead charges' have again been kept at a low figure. The total cost at headquarters was less than 3 per cent. of the gross expenditure, and overheads at all the eight bureaux only exceeded 3 per cent. by a small fraction. Ninety per cent. of the gross expenditure was incurred in the examination, abstraction and distribution of scientific information, and in the purchase of necessary scientific books and periodicals.

3. Not only have the Bureaux been thus very economically administered but a very high proportion of the gross expenditure has gone on the actual collection and dissemination of scientific information. All overseas workers are indebted to the Institutes at which the Bureaux are situated for their very generous help.

4. The quality of the various publications issued by the eight different bureaux from time to time has been well maintained and the publications have been consistently practical and useful in character. This is illustrated by the fact that notwithstanding the continuance throughout 1932-33 of severe general economic depression the sales of every one of the journals issued by the bureaux show some increase.

5. Several of the Bureaux have extended their system of lending translations and extended abstracts of articles of special value appearing in foreign journals. This service and the special articles contributed by certain of the Bureaux has been greatly appreciated by research workers in all parts of India.

6. The fourth Report (Not printed) is now for the consideration of the Advisory Board.

APPENDIX XV.

NOTE, DATED THE 31ST AUGUST, 1934, ON SUBJECT No. 6-A, PROGRESS REPORT ON THE WORKING OF THE BOTANICAL SUB-STATION AT KARNAL FOR THE YEAR ENDING JUNE 1934.

The above report (not printed) submitted by the Director, Imperial Institute of Agricultural Research, Pusa, is for the consideration of the Advisory Board. Progress reports for the periods 1st April 1931 to 30th June 1932 and 1st July 1932 to 30th June 1933 were submitted to the Board at its meeting held in August 1933, *vide* pages 382 and 385—401 of the printed proceedings of the Board.

APPENDIX XVI.

NOTE, DATED THE 1ST SEPTEMBER 1934, ON SUBJECT No. 6-B, SCHEME FOR THE EXTENSION OF THE BOTANICAL SUB-STATION AT KARNAL FOR A PERIOD OF FIVE YEARS AT A COST OF Rs. 1,30,080.

At its meeting held in June 1930, the Advisory Board recommended a scheme for the establishment of a sub-station of the Botanical Section of the Imperial Institute of Agricultural Research, Pusa, at Karnal, at a recurring cost of Rs. 1,23,850 spread over five years (*vide* pages 6—8 and 36—41 of the printed proceedings of the Board). The scheme was sanctioned by the Governing Body in July 1930 with an additional grant of Rs. 10,000 towards non-recurring expenditure (which had been omitted when it was placed before the Advisory Board) and was started with effect from the 1st October 1930. Progress reports on the working of the scheme for the periods 1st April 1931 to 30th June 1932 and 1st July 1932 to 30th June 1933 were placed before the Board at its meetings held in August 1933 (pages 385 to 401 of the printed proceedings). The progress report for the year ending 30th June 1934 is being placed before the Board as item No. 6-A of the agenda.

2. The Director, Imperial Institute of Agricultural Research, Pusa, has now applied for an extension of the scheme for a further period of five years at Karnal and later at Pusa, from the date of its termination, namely September 1935, at a recurring cost of Rs. 1,30,080 spread over that period. The Government of India have approved this application and a copy of their letter No. F. 41-3/34-A, dated the 1st September forwarding the application is enclosed (Annexure). The probable cost on the existing scheme which results in a saving of about Rs. 15,000 and the details of the proposed extension will be found in Annexures A and B to the letter from the Director, Imperial Institute of Agricultural Research, Pusa, dated the 29th August, 1934 (Enclosure II to Annexure).

3. The subject is for the consideration of the Advisory Board.

ANNEXURE.

No. F. 41-3/34-A.

GOVERNMENT OF INDIA.

DEPARTMENT OF EDUCATION, HEALTH AND LANDS.

Simla, the 1st September, 1934.

From

K. R. MENON, Esq., I.C.S.,

Offg. Addl. Deputy Secretary to the Government of India,

To

The Secretary,

Imperial Council of Agricultural Research.

Scheme for the continuance of the Botanical Sub-station, Karnal.

Sir,

I am directed to forward a revised scheme submitted by the Director, Imperial Institute of Agricultural Research, Pusa, for the continuance

for a further period of 5 years at Karnal and later at Pusa of the Sub-station of the Botanical Section of the Imperial Institute of Agricultural Research, together with a copy of his letter No. 495/C., dated the 29th August, 1934. The Government of India approve the scheme, which it will be seen, involves a total expenditure of Rs. 1,30,080 recurring for the extension period from October, 1935, to September, 1940. In the ordinary course, the Director, Imperial Institute of Agricultural Research, Pusa, would have been directed to forward the scheme to you so that it might be placed before the Imperial Council of Agricultural Research. As, however, the next meeting of the Advisory Board of the Imperial Council of Agricultural Research is to be held early this month, I am directed to forward the scheme direct and to ask that the decision of the Council may be communicated to the Government of India in due course.

I have the honour to be,

SIR,

Your most obedient servant,

K. R. MENON,

Offg. Addl. Deputy Secretary.

Enclosure I.

COPY OF A LETTER FROM THE DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, No. 495/C. OF 1934, DATED THE 29TH AUGUST, 1934.

Revised scheme for the continuance of Sub-station of the Botanical Section at Karnal and at Pusa.

I have the honour to refer to my letter No. 9/C. of the 12th May, 1934, submitting a proposal for the continuance of the Botanical Sub-Station at Karnal for a further period of 5 years. Consequent upon the decision of Government of India to transfer the Institute from Pusa to the neighbourhood of Delhi, I submit a revised scheme for the continuance of the Botanical Sub-Station first at Karnal and later, when the institute is established in the neighbourhood of Delhi, at Pusa. I beg to call your attention to the fact that the revised scheme does not involve the provision of funds for non-recurring expenditure.

Enclosure II.

Revised scheme for the continuance of the Botanical Sub-Station, Karnal, financed by the Imperial Council of Agricultural Research, for a further period of 5 years.

The objects with which the Botanical Sub-Station was established at Karnal are fully explained in the original scheme forwarded under my letter No. 9/C., dated 12th May 1934.

When the Pusa Institute is established in the neighbourhood of Delhi it will no longer require a Sub-Station at Karnal which is only 70 miles from the site of the new institute. All the objects for which the Botanical Sub-Station was established at Karnal will be fulfilled by the Botanical

Section at the new site. It is, however, necessary to make some provision for botanical work in North-East India and for this reason I propose that when the Institute is established on the new site the Botanical Sub-Station at Karnal should be transferred to Pusa.

The object of a Botanical Sub-Station at Pusa are :--

- (1) Breeding and testing varieties suitable for North-east India.
- (2) Multiplication of seed for North-eastern provinces under conditions which would make supply cheaper owing to saving in freight.
- (3) Training of post-graduate students under agricultural conditions which differ from those which prevail at the new site.

The Botanical Sub-Station at Pusa would consist of the present Botanical area and the Punjab Experimental Field of the Agricultural Section. The Punjab field contains the permanent-manurial experiments which have been carried out at Pusa for the last 26 years and the inclusion of this field in the Sub-station will provide for the continuance of the chief agricultural experiments at Pusa. The staff of the Sub-station can easily attend to these experiments.

The maintenance of Botanical Sub-station at Pusa will ensure that some lines of botanical work, for example, breeding work with pigeon-pea and tobacco investigations for which the climate of Pusa is well suited, will not suffer by the transference of the Institute to the neighbourhood of Delhi. It will moreover provide a centre at which early ripening varieties in the course of plant breeding investigations can be tested for their suitability for the North-eastern area of India in which the growing season is considerably shorter than at Delhi.

The scheme for the Botanical Sub-station differs in one important respect from almost all other schemes which have been financed by the Council. The Botanical Sub-station was not founded for the investigation of any one definite research problem. In this respect it differs from a scheme for research on some single problem in chemistry or physiology. Schemes of this latter type will ultimately terminate with the solution of the problem but schemes as that of the Botanical Sub-station which tackle general investigations in plant breeding, agriculture and disease will never reach a stage at which all their investigations are solved. Each research which is successfully concluded breeds new problems and there can be no finality to the labours of the plant breeder and of his colleagues who investigate disease.

The line of work which will be carried out at the Botanical Sub-station in the next five years (1935—1940) will, therefore, involve the continuance of plant breeding investigations on those crops which have already been mentioned (*e.g.*, wheat, barley, oats, gram, etc.), the testing of varieties bred at Pusa and at Karnal which appear suitable for North-east India, the multiplication of seed of standard types, the training of post-graduate students. The Sub-station will continue to afford facilities to the mycological and entomological sections for the study of disease under conditions differing from those of Delhi.

The present scheme of the Botanical Sub-station at Karnal terminates in October 1935 and it is unlikely that the research institute will

be established at the new site until early 1937. The present scheme therefore provides for the continuance of the Botanical Sub-station at Karnal until the institute is established in the Delhi Province and the transfer of the Sub-station after that date to Pusa. Since ample buildings, etc., exist at Pusa it is not necessary to make any provision for non-recurring expenditure at Pusa. The Botanical Sub-station at Karnal will become, with the addition of some extra land from the Imperial Cattle Breeding Farm, the Sub-station of the Agricultural Section for the growing of fodder crops and the multiplication of seed.

The non-recurring expenditure which was contemplated in the original scheme at the Botanical Sub-station at Karnal will not be required as such additional buildings, etc., as are required by the Agricultural Section will fall on the capital expenditure for the construction of the new research institute.

Expenditure.

The expenditure already incurred and likely to be incurred during the present term of 5 years is estimated at Rs. 1,18,400 as follows (*vide* details in Annexure A) :—

				Rs.
October 1930 to March 1931	..	..		21,104
1931-32	..	..	..	20,230
1932-33	..	..	..	21,605
1933-34	..	..	..	21,600
1934-35	..	..	..	22,400
April 1935 to September 1935	..	..		11,450
				<hr/>
				1,18,389
		or say		<hr/> 1,18,400 <hr/>

The probable recurring expenditure required for the proposed extension period of 5 years will amount to Rs. 1,30,080, as follows (*vide* details in Annexure B)—

				Rs.
October 1935 to March 1936	..	..		13,000
1936-37	..	..	..	24,960
1937-38	..	..	..	25,530
1938-39	..	..	..	26,100
1939-40	..	..	..	26,640
April 1940 to September 1940	..	..		13,850
				<hr/>
				1,30,080 <hr/>

Receipts.

It has been decided that half the receipts of the Sub-station should go to the Imperial Council of Agricultural Research and half to the Government of India. The following is the estimate for the present and the proposed terms—

1930-35.	Total.		Share of Imperial Council of Agricultural Research.	
	Rs.	a. p.	Rs.	a. p.
October 1930—30th June 1931	9	8 0	..	..
1st July 1931—30th June 1932	1,250	7 9	..	..
1st July 1932—30th June 1933	4,433	10 6	2,216	13 3
1st July 1933—10th May 1934	3,452	12 10	1,726	6 0
11th May 1934—31st October 1935	6,000	0 0	3,000	0 0
(Approximate)	15,146	5 1	6,943	3 3

Estimated receipts for period October 1935—September 1940.

Total.

Share of Impl. Council of Agril. Research.

Rs.
15,000

Rs.
7,500

ANNEXURE "A".

Expenditure already incurred or likely to be incurred on the Botanical Sub-station, Karnal, during the sanctioned period of 5 years from October 1930, to September 1935 :—

Year.	Head of expenditure.		Total.
	Staff.	Other Charges.	
	Rs.	Rs.	Rs.
October 1930 to March 1931	656	20,448	21,104
1931-32	6,901	13,329	20,230
1932-33	8,313	13,292	21,605
1933-34	8,923	12,677	21,600
1934-35	9,600	12,800	22,400
April 1935 to September 1935	5,050	6,400	11,450
Total	39,443	78,946	1,18,389

Grand Total
or
1,18,389
1,18,400

ANNEXURE " B ".

Statement of probable recurring expenditure for the Botanical Sub-station during the extension period of 5 years from October 1935 to September 1940 :—

Year.	Head of expenditure.			Total.
	Officers.	Establishment.	Other charges.	
	Rs.	Rs.	Rs.	Rs.
October 1935 to March 1936 ..	2,280	2,820	7,900	13,000
1936-37	4,760	5,900	14,300	24,960
1937-38	5,000	6,230	14,300	25,530
1938-39	5,240	6,560	14,300	26,100
1939-40	5,480	6,860	14,300	26,640
April 1940 to September 1940 ..	2,880	3,570	7,400	13,850
Total ..	25,640*	31,940*	72,500	1,30,080

* For details see annexure B.-1.

Total Recurring expenditure 1,30,080

ANNEXURE " B-1 ".

Details of expenditure required on account of staff of the Botanical Sub-station during the extension period.

(Rounded to tens).

	October 1935 to 1936.	1936-37.	1937-38.	1938-39.	1939-40.	April 1940 to September 1940.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
OFFICERS.						
Farm Superintendent 300—20—800 (380—date of increment 28th March) ..	2,280	4,760	5,000	5,240	5,480	2,880
ESTABLISHMENT.						
Farm Assistant 100—10—300 (120—date of increment 20th February) ..	730	1,570	1,690	1,810	1,930	1,020

ANNEXURE "B-1"—*contd.*

(Rounded to tens.)

—	October 1935 to 1936.	1936-37.	1937-38.	1938-39.	1939-40.	April 1940 to September 1940.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Establishment— <i>contd.</i>						
Storekeeper 40—3— 70—2½—100 (55— date of increment 20th October) ..	330	670	710	750	780	400
Fieldman 40—4—120 (56—date of incre- ment 1st December)	340	730	780	830	880	460
Clerk 40—3—70—2½ —100 (52—date of increment 2nd Feb- ruary) ..	310	660	700	740	770	400
Head Mali 30—2—50 (40—date of incre- ment 2nd October)	240	490	510	540	560	290
Mistri 50—2½—75 (60 —date of increment 23rd April) ..	360	750	780	810	840	440
Assistant Mali 15—1 —25 (18—date of increment 1st May) ..	110	230	240	250	260	140
Assistant Mali 15—1 —25 (19—date of increment 1st Nov- ember) ..	120	240	260	270	280	140
Chaukidars (2 @ Rs. 16) and peon (1 @ Rs. 15) ..	280	560	560	560	560	280
	2,820	5,900	6,230	6,560	6,860	3,570

Total expenditure—Officers—Rs. .. 25,640

Total expenditure—Establishment—Rs. .. 31,940

APPENDIX XVII.

NOTE, DATED THE 10TH AUGUST 1934, ON SUBJECT NO. 7, APPLICATION FROM THE DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, PUSA, FOR A GRANT OF RS. 29,360 SPREAD OVER FIVE YEARS FOR A SCHEME FOR RESEARCH ON THE CYTOLOGY OF INDIAN CROPS AT PUSA.

Attention is invited to the attached letter (Annexure) from the Government of India, Education, Health and Lands Department, No. F. 125/34/A., dated the 8th August 1934, forwarding the application mentioned above. The scheme involves so far as the Council is concerned, non-recurring expenditure of Rs. 2,000 and recurring expenditure of Rs. 27,360 or a total expenditure of Rs. 29,360 spread over five years.

2. This scheme does not appear to overlap the scheme of work on the cytology of crop plants (Madras University) either in regard to the general programme of work or the crops which would be studied. The scheme is for the consideration of the Advisory Board.

ANNEXURE.

COPY OF A LETTER FROM THE OFFG. ADDITIONAL DEPUTY SECRETARY TO THE GOVERNMENT OF INDIA, EDUCATION, HEALTH AND LANDS DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NO. F. 125/34-A., DATED THE 8TH AUGUST 1934.

Scheme for research on the Cytology of Indian crops to be conducted at Pusa and financed by the Imperial Council of Agricultural Research.

I am directed to forward a scheme submitted by the Director, Imperial Institute of Agricultural Research, Pusa, for conducting research on the Cytology of Indian crops in the Botanical Section at Pusa, together with a copy of his letter No. 2234, dated the 2nd May, 1934. The Government of India approve the scheme which, it will be seen involves an expenditure of Rs. 29,400 spread over a period of five years. In the ordinary course the Director, Imperial Institute of Agricultural Research, Pusa, would have been directed to forward the scheme to you so that it might be placed before the Imperial Council of Agricultural Research, with a request that a grant should be made to meet the cost. It is, however, understood that the next meeting of the Advisory Board will be held in Simla in the beginning of September next, and, in order to save time, I am directed to forward the scheme direct, and to ask that the decision of the Council may be communicated to the Government of India in due course.

COPY OF A LETTER FROM THE DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, PUSA, TO THE SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, NO. 2234, DATED THE 2ND MAY 1934.

Scheme for research on the Cytology of Indian crops to be conducted at Pusa and financed by the Imperial Council of Agricultural Research.

I have the honour to forward for the consideration of the Government of India a scheme for conducting research on the cytology of Indian crops in the Botanical Section of the Imperial Institute of Agricultural Research, Pusa, to be financed by the Imperial Council of Agricultural Research.

2. The scheme is intended to fill an important gap in the plant breeding investigations at this Institute and deserves to be favourably considered. It will run for a period of 5 years and involves a total expenditure of Rs. 29,400.

3. Should the proposal meet with the approval of Government it is requested that it may be forwarded direct to the Imperial Council of Agricultural Research to enable the Council to place it before the next meeting of the Advisory Board.

SCHEME FOR CARRYING ON RESEARCH ON THE CYTOLOGY OF INDIAN CROPS AT PUSA.

I submit herewith a scheme for initiating and carrying on research on the cytology of Indian crops with special reference to those that have formed or are forming the subject of plant breeding investigations at Pusa.

The lack of cytological studies has hitherto constituted the most serious gap in our genetical and plant breeding investigations at Pusa. Of the large number of papers written in the Botanical Section during the time of the Howards at Pusa, none are concerned with cytology, and of the 53 publications which have come from the section since 1924 only 3 papers deal with this subject. These are short papers, the work of a post-graduate student and we have not got on the staff any officer who is competent to tackle this line of research. Cytological studies of the cell changes preceding gametogenesis form an essential part of all genetical investigations and indeed our knowledge of the possibilities of hybridisation cannot be complete without information as to the chromosome numbers in different crop plants. Cytological research does not in itself generally offer results of direct economic value, but it should form part of the work of the Botanical Section at Pusa both on account of its necessity for the completion of genetical studies and for the training of post-graduate students, who should have some practical knowledge of the actual mechanism of heredity. The scheme should be for 5 years.

The equipment necessary for this line of work is already to a large extent in existence in the section. The section possesses a large size Zeiss microscope with apochromatic lenses, which is the most expensive item, and a good stock of the smaller articles required for this work. Accommodation for the cytologist can be found in the existing Botanical laboratories and no new buildings need be provided.

Such assistance as the cytologist requires can be rendered by the permanent staff of the section, it is not therefore necessary to recruit more than one officer, for the post of cytologist, for this work. I estimate the following non-recurring expenditure on apparatus will suffice.

(1) Microtome	..	..	..	..	..	800
(2) Glass ware	..	..	..	..	..	200
(3) Paraffin bath	..	..	..	..	..	150
(4) Vacuum desiccator	..	..	..	..	..	50
(5) Filter pump	..	..	..	..	..	50
(6) Lenses	..	..	..	..	..	250
(7) Eyepiece camera	..	..	..	..	..	250
(8) Macrograph	..	..	..	..	..	150
(9) Microscope lamp	..	..	..	..	..	100

Total	2,000
-------	-------

The recurring contingent expenditure estimate at—

Slide and coverslips, glass-ware	}	500
Alcohol	..	..
Xylol	..	..
Rectified spirit	..	..
Paraffin	..	..
Stains	..	..

Staff.—One cytologist, experienced in cytological research and with published papers in cytology, trained in Europe, Honours degree in Botany, of M. Sc. Pay Rs. 350—20—490.

(The selected candidate can be given initial pay within this scale with due regard to his qualifications).

Estimate of Total expenditure.

		Rs.
Non-recurring	.. .. .	2,000
Recurring—		
(a) Apparatus, etc., at Rs. 500 per annum for five years	..	2,500
(b) Cytologist at Rs. 350—20—490—		
1st year	.. .. .	4,200
2nd year	.. .. .	4,440
3rd year	.. .. .	4,680
4th year	.. .. .	4,920
5th year	.. .. .	5,160
		<hr/>
	23,400	23,400
(c) Provident fund at 1/16 of pay	.. .. .	1,460
		<hr/>
Total for 5 years	..	29,360

(Sd.) F. J. F. SHAW,
Imperial Economic Botanist, Pusa, Bihar.

APPENDIX XVIII.

NOTE, DATED THE 9TH AUGUST, 1934, ON SUBJECT No. 8, PROCEEDINGS OF THE SECOND MEETING OF THE FERTILISER'S COMMITTEE HELD IN FEBRUARY 1934.

The proceedings of the Second Meeting of the Fertilisers Committee held in February 1934 (not printed) are circulated for the information of the Advisory Board.

2. The recommendations made by the Fertilisers Committee on the various items of their Agenda and the action taken thereon have been summarised in the attached statement (Annexure).

ANNEXURE.

Statement showing the recommendations contained in the proceedings of the Second Meeting of the Fertilisers Committee.

Serial No.	Item No. of the Agenda.	Subject.	Recommendation of the Committee.	Action taken.
1	1	Decisions of the Governing Body on the recommendations of the Fertiliser's Committee, First Meeting.	Noted	No action required.
	2	Collection of data of manurial experiments conducted in the past.	(A) <i>Programme of manurial experiments, on uniform lines, for future.</i> It was agreed that the financial aspect of manuring was largely local and that a well planned series of manurial experiments would give information of permanent value from which the probable profit of manuring with any given combination of prices for fertiliser and crop could be worked out. As regards the technical lay-out for the future programme of experiments, it was agreed that (i) randomised experiments should be carried out and (ii) a special scheme of research to determine the best methods of lay-out should be conducted by the Statistician to the Council in co-operation with Agricultural Officers at those farms which had sufficient land and facilities for the purpose.	The Statistician is in communication with the Agricultural Officers concerned.
3	"	Ditto ..	(B) <i>Number of replications to be adopted in future experiments.</i> It was decided that the Committee should recommend seven as the minimum number of replications for all fertiliser experiments in the general scheme to be put forward.	The attention of all Departments will be invited to this recommendation.

4	2	Ditto	..	<p>(C) <i>Most suitable size and shape for experimental plots.</i></p> <p>It was decided that with the advice of the Statistician to the Council experiments should be conducted wherever possible to determine the ideal size of plot for different crops under different conditions. The question of the shape of the plot also should be decided by each experimenter in consultation with the Statistician to the Council.</p>	The Statistician is in communication with Agricultural Officers.
5	"	Ditto.	..	<p>(D) <i>Analyses of the soil of experimental plots.</i></p> <p>(i) <i>Chemical Analyses.</i>—It was decided that the minimum requirements would be the determination of (a) Total phosphates, (b) Available phosphates (by an agreed common method), (c) Total potash, (d) Available potash (by an agreed common method); (e) Lime, (f) Hydrogen in concentration (by an agreed common method) and (g) Organic matter by an agreed method. As regards methods of analysis it was decided that the Agricultural Chemists of all the Provinces should meet and discuss the methods to be adopted.</p> <p>(ii) <i>Physical (Mechanical) Analysis.</i>—It was unanimously agreed that a mechanical analysis should be made for each block both by the "International" method (to secure complete dispersion) and after 12 hours shaking with water only. The first method would enable different soils to be compared, the second approximated more nearly to actual field conditions.</p> <p>(iii) <i>Biological Analyses.</i>—These would throw considerable light on fertility problems but as they could not be undertaken in any province except at a few special farms, it was left to Provincial Agricultural Chemists to consider what was possible in this direction.</p>	The attention of Agricultural Departments will be drawn to this recommendation.
6	"	Ditto	..	<p><i>Base Exchange.</i>—In several provinces special studies of the exchangeable bases of the different soils are in progress. The correlation of these results with those of fertiliser experiments will undoubtedly be very profitable.</p>	No action required.

Ditto.

Serial No.	Item No. of the Agenda.	Subject.	Recommendation of the Committee.	Action taken.
7	2	Collection of data of manurial experiments conducted in the past— <i>contd.</i>	<i>Period of experiments.</i> —From the weather sampling point of view, a minimum of five years period was recommended. From the point of view of the cumulative effect of fertilisers a minimum period of three full rotations, i.e., generally nine years was recommended.	The attention of Agricultural Departments will be drawn to this recommendation.
8	"	Ditto	It was suggested that the Statistician should issue a small pamphlet containing instructions on statistical analyses which would be of use to all experimenters. This might contain the prescribed methods of statistical analysis and give examples.	This is receiving attention.
9	"	Ditto	The following two Resolutions were passed :— "1. That the survey of manurial experiments carried out in India establish the importance and suitability of indigenous organic manures like cattle manure, green manures, bone-meal, fish-manure, oil cakes ;	Noted.
9	"	Ditto	2. That artificial fertilisers give the best results in conjunction with organic manures or in the presence of adequate supplies of organic matter in the soil."	Noted.
10	"	Ditto	<i>Future Programme of Work.</i> —The continuation of all long term manurial experiments in the provinces was recommended. It was brought to the notice of the Committee that the land on which the experiments were conducted at Cawnpore, United Provinces, was transferred to the Agricultural College as an instructional Farm and it could not be said with certainty whether it was possible to revive the experiments on these plots. The Committee regretted the discontinuance of the former set of experiments which were initiated nearly half a century ago and decided that an enquiry be made from the United Provinces Government as to whether the experiments could be revived.	This recommendation is for consideration by the Advisory Board.

11 2

Ditto

The following types of manurial experiments, were recommended in order of importance :—

- (1) Further investigation of the exact manurial value of Farm-yard manure.
- (2) On investigation into residual effects of manures—especially organic manures (including oil cakes and bonemeal).
- (3) Investigation of the best Nitrogen Phosphate ratios for important crops.
- (4) A study of the effect of phosphatic manures on the yields of pulses and of green manure crops.
- (5) Experiments with Potassium Nitrate.
- (6) Investigations into the effect of Potash manures on disease resistance.
- (7) Experiments on the relative value of the ammonium phosphate type of fertilisers and mixtures containing both soluble nitrogen and phosphates.
- (8) Experiments to compare farmyard manure made by the loose box method with composts in which urine is mixed, and with urine earth.
- (9) Residual effect experiments on (a) farmyard manure; (b) oil cakes; (c) bone-meal; (d) oil cakes *plus* bone-meal; (e) Sulphate of Ammonia *plus* Super-Phosphates.
- (10) Experiments on the liming of soils to ascertain the effect of liming on both the yield and the chemical composition of fodder crops were recommended in provinces where there is a large *Jowar* area with acid soils. The experiment might also be tried on rice lands in Kanara and on Jowar lands in Surat.

11 "

Ditto

The Committee agreed that experiments should be carried out with all the crops included in one standard rotation in each province.

12 3

Enquiry into the question of the market for superphosphates in India.

It was decided to drop the question for the present

.. ..

No action required.

Serial No.	Item No. of the Agenda.	Subject.	Recommendation of the Committee.	Action taken.
13	4	Investigation of the possibility, in India of making Nitrogen from the air.	It was decided that the Director of Indian Institute of Science, Bangalore, who is a member of the Advisory Board of the Council, be asked to advise in the matter and furnish information as to the price per unit of electric energy which could be paid and the smallest economic plant.	The Director of the Indian Institute of Science, Bangalore, has been addressed on the subject.
14	5	The need for an all-India Fertilisers Act.	It was agreed that the matter should be put before the next meeting of the Advisory Board. Meanwhile the members from each province undertook to examine the practicability of a law insisting on labels stating the composition of the manure and the desirability of prohibiting ready made mixtures of unstated composition. It was also considered that the opinions of fertiliser manufacturers should be obtained and laid before the Board.	Members of the Fertilisers Committee and the Fertiliser Manufacturers have been addressed accordingly and their replies will be placed before the Advisory Board.
15	6	Existing condition of the fishing industry and its possibilities of development in so far as supplies of fish manure are concerned.	The Committee recorded its opinion that, on the information before it, fish manure was valuable as manure and as food for live stock and recommended its development by the provinces concerned.	Placed on the Agenda for the meeting of the Advisory Board to be held in September, 1934.
16	7	Possibilities of establishing a fish guano industry on the Chilka Lake.	The Committee decided to take no further action in the matter ..	No action required.
17	8	Experiment on some methods of disintegrating bones by previous fermentation.	The Committee agreed that schemes be invited with a view to (i) work being undertaken for purposes of demonstration on the basis of the experiments carried out by Rao Bahadur Sahasrabudhe and Dr. Lander and (ii) experiments in composting crushed bones using if possible the "prize" crusher if it passed its practical trials.	Placed on the Agenda for the meeting of the Advisory Board to be held in September, 1934.
18	9	Economics of Bone-meal production : data in regard to collection, transportation of bones, etc.	It was decided that the Questionnaire be circulated to all Provincial Departments of Agriculture.	The Boards of Economic Enquiry, Punjab, and the United Provinces are being addressed on the subject.

19	10	Question of concession rates for the carriage of bone-meal.	The Committee considered that individual cases might be taken up with the local railway advisory committees. If an official reference was necessary it should be made through the Local Government.	No action required.
20	11	Levy of a duty on the export of oil-seeds, bone and bone-meal.	The Committee considered that in the present circumstances no action should be taken in the direction of levying an export duty.	Noted.
21	12 (i)	Proposals that Agricultural Departments should experiment with Nitrate of Potash as a source of Nitrogen in place of imported Nitrogenous manures.	The Committee noted that this had been included in the future programme of work recommended by the Committee under Subject No. 2 of the Agenda.	No action needed.
22	12 (ii)	Suggestion by Messrs. The Cawnpore Chemical Works Ltd., Cawnpore, regarding the use of bone superphosphate in place of imported rock superphosphate as manure by Agricultural Departments in India.	The Committee expressed the opinion that as bone phosphate contained nitrogen and was therefore a better fertiliser than rock superphosphate. Agricultural Departments already recommend the use of the former wherever available.	The firm have been informed.
23	13	Use of Poudrette as manure.	It was decided to record the papers	Recorded.
24	14	Conservation of cattle dung for use as manure (Note by Mr. F. L. Brayne, M.C., I.C.S.)	The Committee was of the opinion that it is well known that cow dung has a high manurial value and its use as fuel is declining gradually and that no action is called for on the part of the Committee.	Noted.
25	15	Application from the Government of Madras for a grant of Rs. 92,487 spread over a period of 3 years for a scheme of research for improving the fishing industry and developing the supply of fish manure.	The Committee recommended the scheme on account of the high feeding and manurial value of fish meal and fish manure, subject to the condition that the Madras Government revives the measures previously adopted for the development of deep-sea fishing.	Placed on the Agenda for the meeting of the Advisory Board to be held in September, 1934.

Serial No.	Item No. of the Agenda.	Subject.	Recommendation of the Committee.	Action taken.
26	16-A	Note by the Statistician to the Council on the comparative manurial value for sugarcane of oil cake and ammonium sulphate.	These subjects were covered by the future programme of work already proposed by the Committee and no further action was considered necessary.	Noted.
27	16-B	Proposal by Rao Bahadur D. L. Sahasrabudhe that Provincial Directors of Agriculture be recommended to take up experiments to determine the residual effects of bulky manures on important soils in their provinces.		
28		Mr. Ramadas Pantulu considered that in view of the terms of reference to this Committee, it was necessary for the Committee to submit a formal report on the subject. As they were not in a position to prepare a final report at the present stage, it was decided that a draft interim report should be prepared by the Council's Secretariat indicating the recommendations made by the Committee so far and circulated to the members of the Committee for approval.		
				This is being done.

APPENDIX XIX.

NOTE, DATED THE 10TH AUGUST 1934, ON SUBJECT No. 14, RECOMMENDATIONS OF THE CROP PLANNING SUB-COMMITTEE OF THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, JUNE 1934.

As a result of the discussions at the Provincial Economic Conference held by the Government of India in April 1934, the Government of India decided to hold a Crop Planning Conference in June 1934, consisting of Provincial Directors of Agriculture, Revenue Officers and others, to discuss what measures could be taken to co-ordinate agricultural production for India.

The Government of India invited the Imperial Council of Agricultural Research to appoint a technical Sub-Committee of the Advisory Board for the purpose of preparing and framing issues and drafting resolutions for its consideration. Immediate action being necessary, the Vice-Chairman accepted the invitation of the Government of India on behalf of the Advisory Board and in anticipation of its approval. The Board is now invited to ratify his action by a formal resolution appointing the Committee under Rule 48 of the Rules and Regulations of the Council.

2. The personnel of the Sub-Committee and its terms of reference are stated in the attached note, dated the 4th May 1934, which was circulated to the Committee (Annexure I). The Sub-Committee met on the 5th—7th June 1934 and a copy of its recommendations and proposals is attached (Annexure II)*. A resume of the discussions in the Crop Planning Conference is attached for the information of the Advisory Board (Annexure III)*. Certain of the recommendations made by the Conference call for action by the Imperial Council of Agricultural Research—these will be brought before the Board in due course. At the present meeting the report of the Tobacco Committee and proposal for the establishment of Standing Committees for wheat and rice will come up for discussion.

ANNEXURE I.

COMMITTEE ON CROP PLANNING OF THE ADVISORY BOARD
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RE-
SEARCH, JUNE 1934.

Paragraph 10 of the Resolution of the Government of India, No. F. 16 (1)-F./34, dated the 5th May 1934, is as follows :—

Crop Planning.—An essential complement to any programme for marketing is the regulation of production in adjustment to the demand. The discussions initiated by the Governments of Madras and the Punjab on rice and wheat disclosed the danger of serious relative over-production of these important crops having regard to the world position, and, as regards wheat, as the result of the rapid opening up of the areas irrigated by the Sukkur Barrage. On the other hand it is to be remembered that the demand for other crops, or for products of animal husbandry in substitution for crops, may be relatively more favourable, and in particular that the Ottawa preferences have

created new opportunities for Indian produce in the British market (notably for linseed, barley, etc.) of which it is vitally important that India should take full advantage. The Government of India consider that it is a matter of most urgent importance that all possible steps should be taken to co-ordinate a plan of agricultural production for India as a whole, and they have therefore decided, in agreement with the conclusions reached in these discussions, to propose to the provincial Governments that a conference shall be held at the earliest possible date of provincial Directors of Agriculture and land revenue officers to discuss what measures can be taken in this direction. It is important that such measures as are immediately possible should be taken before the sowing season for the next cold weather.

* * * * *

2. In accordance with the above decision the Government of India is addressing Local Governments proposing that a Conference of Directors of Agriculture and land revenue officers should be held in Simla on Friday and Saturday, the 8th and 9th of June 1934. The Vice-Chairman has been requested to call a preliminary meeting of a sub-committee of the Advisory Board of the Imperial Council of Agricultural Research in order to explore the questions involved with particular reference to the complaints of over-production of rice and wheat, and to the possibility of substituting other crops therefor, and to prepare a detailed agenda for the Conference.

3. In response to the request of the Government of India, the Chairman of the Advisory Board in anticipation of the Board's approval appoints under Rule 48 of the Rules and Regulations of the Imperial Council of Agricultural Research the following Sub-Committee :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, *Chairman*.
2. The Agricultural Expert to the Council.
3. The Animal Husbandry Expert to the Council.
4. The Marketing Expert to the Council.
5. The Statistician to the Council.
6. Director of Agriculture, Madras.
7. Director of Agriculture, Bombay.
8. Director of Agriculture, Bengal.
9. Director of Agriculture, United Provinces.
10. Director of Agriculture, Punjab.
11. Director of Agriculture, Burma.
12. Director of Agriculture, Bihar and Orissa.
13. Director of Agriculture, Central Provinces.
14. Chief Agricultural Officer, Sind.
15. Diwan Bahadur T. Raghaviah.

Rai Sahib Malik Charan Das, *Secretary*.

4. The Sub-Committee will meet in Simla on Tuesday and Wednesday, the 5th and 6th June. The exact place and time of the meeting will be communicated later on.

5. The Vice-Chairman believes that on the question of alternative crops and of diversified cultivation there is already a certain amount of information and literature collected in the Provinces. In the discussions at the Provincial Economic Conference it was suggested that linseed could be grown more largely in the Central Provinces in place of wheat, soya bean in Sind, barley in the United Provinces, *sann* hemp in Rohilkhand and fodder crops in place of cereals. Increased cultivation of sugarcane, plantains, betel-vine, tobacco, fruits and vegetables and pulses of all kinds in substitution for rice has been recommended in Madras in the past. The Secretariat of the Imperial Council of Agricultural Research is at work preparing statistical material for the Sub-Committee and the Vice-Chairman will be grateful if Directors of Agriculture will examine the information already available in the provinces and send in to the Secretary to the Imperial Council of Agricultural Research such information as they consider will be useful to the Sub-Committee and also suggestions as to the agenda for the meeting. It will be a great convenience if these could reach the Council's office a week before the meeting.

CHARAN DAS,

Secretary.

The 4th May 1934.

APPENDIX XX.

NOTE, DATED THE 26TH MAY, 1934, ON SUBJECT No. 53, APPLICATION FROM THE ANDHRA UNIVERSITY FOR A GRANT OF Rs. 5,000 SPREAD OVER A PERIOD OF TWO YEARS FOR A SCHEME TO INVESTIGATE THE COMMERCIAL PRODUCTION OF SWEET POTATO STARCH BY DR. D. G. WALAWALKAR, B. AG., M. SC., HEAD OF THE DEPARTMENT OF TECHNOLOGY, ANDHRA UNIVERSITY.

Attention is invited to the attached letter from the Government of Madras, No. 446-Ms., dated the 4th April 1934 (Appendix), forwarding *inter alia* the Scheme mentioned above. The Scheme involves an expenditure of Rs. 5,000 spread over a period of two years.

The Scheme is now for the consideration of the Advisory Board.

(APPENDIX.)

Copy of a letter No. 446-Ms., dated the 4th April 1934, from the Secretary to the Government of Madras, to the Secretary, Imperial Council of Agricultural Research.

ANDHRA UNIVERSITY SCHEMES.

I am directed to forward the following schemes submitted by the Registrar, Andhra University, Waltair for financial assistance from the Council :—

- (1) Commercial production of sweet potato starch ;
- (2) Study of fruits and vegetables with a view to their utilisation in manufacture ; and
- (3) Technology of tobacco waste.

2. The schemes were circulated to the members of the Provincial Research Committee. The first scheme has been recommended by four members, the second by three and the third by six including the Director of Agriculture. In the opinion of the Local Government, however, none of the schemes are deserving of financial aid from the Council.

3. 150 spare copies of each of the schemes have already been forwarded direct to the Council by the University.

A scheme by Dr. D. G. Walawalkar, B.Ag., M.Sc., M.I.S.S.T., etc., Head of the Department of Technology, Andhra University, for a grant from the Imperial Council of Agricultural Research.

COMMERCIAL PRODUCTION OF SWEET POTATO STARCH.

The districts in the Andhra area, especially the agency tract, grow on a large scale the crop of Sweet Potato. This is one of the good crops of this area, and the cultivated area under it is a large one ; it also is grown semi-wild and thrives well ; besides, it is also an all India crop. Both red and white varieties (from the colour of the tubers) are grown and sell cheap. This crop has a future in this area if it is scientifically cultivated for larger production which may be put to commercial use.

It is intended to undertake the possible commercial production of the starch from the edible tubers which contain mostly starch. Certain mechanical and chemical equipment for disintegration of the tubers and the winning and purification of the starch will have to be purchased in a miniature semi-commercial form. After the starch is prepared, its utilisation besides its use as starch will also be explored. This can be only done if adequate grant is forthcoming from the Imperial Council of Agricultural Research.

The total expense of the preliminary undertaking is expected to be at least Rs. 5,000. This sum is meant to be utilised in the following way :—

	Rs.
A scholarship for a graduate student working on the problem for the duration of two years ..	2,400
For the purchase of semi-commercial scale mechanical and chemical equipment for quasi-commercial operations and incidental expenses of the operation	2,600
Total ..	<u>5,000</u>

Qualifications, etc., of the applicant.

Name : Dattatray Ganesh Walawalkar, B.Ag., M.Sc., M.A.C.S., M.I.S.S.T.

Age : 35 years.

Qualifications :

Matriculate, Bombay University, 1920. Distinction Mathematics.

Bachelor of Agriculture, Bombay University, 1924, II class.

Demonstrator at Poona Agricultural College, 1924—26.

Master of Science (Sugar Chemistry and Technology), Audubon Sugar School of the Louisiana State University, 1928.

Special qualifications :

Sugar Chemist, Godehaux Sugars, Inc., 1927-28 and 1928-29.

Sugar Chemist in Cuba in 1929-30.

Sugar Chemist in Java in 1929-30.

Manager and Chief Chemist, Vartak's Hanuman Sugar Factory, 1930-31.

Manager and Chief Technologist, Burhwal Sugar Mills Ltd., 1931-32.

Chief Chemist and Technologist, New Swadeshi Sugar Mills, Narkatiaganj, 1932-33.

Teaching : Demonstrator at College of Agriculture, Poona, from 1924 to 1926.

Testimonials :

1. From Dr. C. A. Coates, Ph.D., Dean of Audubon Sugar School, U. S. A.

2. From Dr. W. Burns, D.Sc., Principal, College of Agriculture, Poona.

3. From Mr. B. S. Kamat, B.A., M.L.C., Poona.

Special particulars :

- (a) The applicant is a specialist in all the branches of Sugar Technology, from Soil to Bagging of Sugar, i.e., Sugarcane Agriculture, Sugarcane varieties, Sugar Chemistry, Machinery, and Engineering and all technical details.
- (b) The applicant has studied and knows German, French, Spanish and Dutch languages in which research work appears on Sugarcane and Sugar.
- (c) The applicant has studied the organisation of Sugar research stations and Technological Schools in the United States of America, Cuba, West Indies and Java.
- (d) The applicant has supervised, erected and operated sugar factories in North India and has worked in plants from 100 to 400 tons capacity in India and from 800 to 5,000 tons capacity abroad.
- (e) The applicant has toured and worked in cane Sugar factories in Louisiana, Mexico, Cuba, West Indies, Jamaica and Java, to gain expert knowledge of modern practices in the science of Sugar Technology.
- (f) The applicant is a member of the American Chemical Society and the International Society of Sugarcane Technologists.

Present occupation : Head of the department of Technology, Andhra University, Waltair.

APPENDIX XXI.

NOTE, DATED THE 15TH AUGUST 1934, ON SUBJECT No. 60, PROGRESS MADE IN THE PREPARATION OF STATISTICAL NOTES ON THE TECHNIQUE OF FIELD EXPERIMENTS BY STATISTICIAN, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

Attention is invited to the enclosed extracts (Enclosure I) from the proceedings of the last meeting of the Advisory Board held on the 19th February 1934, on the subject of 'lay-out of field experiments'. In the course of the discussion on the above subject it was suggested that a Series of Statistical notes on the technique of field experiments should be prepared by the Secretariat of the Council for the guidance of the provincial Agricultural Officers.

2. The Fertiliser's Committee of the Council at their meeting held on the 26th February 1934 made a similar recommendation that the Statistician to the Council should issue a standard book explaining the prescribed statistical methods, and giving examples especially from the Indian Experimental data. It was further suggested that the proposed book should be brought up to date from time to time.

3. Accordingly, a list of topics (Enclosure II) on which the Statistician to the Council proposes to write notes was circulated to the Directors of Agriculture of Provinces and States and to other scientific workers in India who are interested in the subject. Most of the Directors have approved of the list suggested by the Statistician, and a few have suggested inclusion of fresh topics.

4. Meanwhile the Statistician to the Council has published a note on "Covariance" in Indian Journal of Agricultural Science (April, 1934) after scrutiny by the Editorial Committee. Two more notes by the Statistician are in the course of preparation and the rest will be taken up in due course.

5. The Statistician has, besides the preparation of these notes, written a monograph on the subject of field experiments at the request of the Director of Agriculture, Bombay, which will be published by the Department of Agriculture, Bombay.

6. The subject is for the information of the Board.

ENCLOSURE I.

EXTRACTS FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD HELD ON THE 19TH FEBRUARY 1934.

* * * * *

11. *The layout of Field Experiments—Proposal to refer to the Crops and Soils Wing of the Board of Agriculture in India. (Subject No. 10 of the Agenda.)*

Mr. Burt, in introducing the subject, said that the Fertilizers Committee would shortly consider the results of manurial experiments, made in India, in the past which had been collated and analysed by the Statistician to the Council but it was already obvious that there was very great need for better-planned field experiments. This confirmed the conclusion

reached by the Board last summer. In his opinion the next step was to secure an adequate discussion of the subject by the Agricultural officers who were actually doing field experiments in the provinces. It was therefore proposed to consider the matter at the next meeting of the Crops and Soils wing of the Board of Agriculture and Animal Husbandry and in the meanwhile it was suggested that the Directors of Agriculture of provinces and States be requested to secure notes and papers from those of their staffs who were interested in the subject. Mr. Carpenter agreed with this view and proposed that a note should be prepared by the Secretariat of the Council which would give a lead. He also enquired why the matter should be considered only by the crops and soils wing and suggested that, as it affected animal husbandry side also, it should be discussed at both the wings of the Board of Agriculture and Animal Husbandry. Particular points of importance were the methods of covariance and the calculation of missing plot yields. Dr. Burns supported Mr. Carpenter's proposal and suggested a series of notes from the Council on such points as :—

- (a) Statistical significance.
- (b) Size of plots and replications.
- (c) Presentation of results, with a short bibliography.

ENCLOSURE II.

Topics on which notes are being prepared by the Statistician, Imperial Council of Agricultural Research.

1. 'Statistical Significance' and the relevance of the various mathematical formulæ employed for deducing significance :

- (a) Mercer and Hall's.
- (b) Student's.
- (c) Engledow and Yule's.
- (d) Fisher's.

2. Size and shape of experimental plot (a) for different crops, (b) for different experiments and (c) under irrigated or unirrigated conditions :

- (a) Sugarcane, wheat, paddy, cotton.
- (b) Varietal, manurial, cultural and irrigation experiments.

3. The number of replications in any experiment :

- (a) Soil gradient. (Tables to be prepared for different percentages of variation in soil fertility.)
- (b) Samples for Entomological and Mycological experiments.

4. 'Border' and 'spacing' effects in experiments on several crops : sugarcane, wheat, paddy and cotton.

5. Formulæ to be employed for 'missing' plots.

6. Statistical methods to be employed for the following cases :—

- (a) To judge 'trend' in yields in the same experimental plot.
- (b) To judge 'seasonal effect'.

(c) To judge 'residual effect'.

(d) To judge interactions of several factors in the same experiment (complicated experiment).

7. Model examples for 'layout' of experiments under Indian conditions :—

(a) Varietal.

(b) Manurial.

(c) Cultivation.

(d) Irrigation (water requirements).

8. Formulae for goodness of fit.

*9. Methods for utilizing preliminary crop data—'Method of Co-variance'.

10. Application of 'Method of Co-variance' (with examples) to :—

(a) Total correlation.

(b) Partial correlation.

11. Discussion of the best method of presentation of experimental details and results.

*A note on this subject has appeared in 'Indian Journal of Agricultural Science'.

APPENDIX XXII.

NOTE, DATED THE 15TH AUGUST 1934, ON SUBJECT No. 61, PRINTING OF PROGRESS REPORTS ON RESEARCH SCHEMES.

The examination of progress reports on the various research schemes financed by the Council is steadily becoming a more important item in the agenda of the Advisory Board. These reports are all considered by special Sub-Committees and it is necessary that they should be in the hands of members well in advance of the Advisory Board meeting. The reports, on the whole, have been well presented and contain ample detail ; the reports made by the Sub-Committees on individual reports have rather tended to emphasise the advantage of adequate detail and to encourage longer reports rather than more condensed ones. As the printing of these reports has now become quite a serious problem and especially the reproduction of illustrations, the following suggestions are put forward, as a basis for discussion, with a view to improving the present procedure :—

(a) It is for consideration whether each Local Government or University should not be asked to arrange for the printing of the necessary number of copies of each progress report including such illustrations as may be necessary. This would greatly simplify the work at headquarters and would be consistent with the existing arrangements under which Local Governments supply the necessary number of copies of applications for grants. On the other hand, this procedure would not enable the expert advisers to draw attention to any omissions in order that these might be rectified before the report is published. Secondly, we have no information as to the time required by Government presses in different provinces to print such reports.

(b) One of the principal difficulties which has arisen at the last three meetings of the Board has been due to the fact that the illustrations sent in, especially graphs, have not been fit for direct reproduction and it has been necessary to have tracings made at the last minute. Often we have had to circulate blue prints because there was no time for the press to reproduce the charts after they have been redrawn. Similarly we have had to circulate prints of photographs when there has not been time to arrange for plates. This is neither satisfactory nor economical. If a report is to be printed at headquarters, it is essential, if delay, and possibly the omission of important illustrations, is to be avoided that the instructions to authors issued by the Research Council in connection with its journals should be followed strictly.

(c) The inclusion of illustrations and the making of blocks add very materially to the cost of printing progress reports and it is suggested that the authors of reports should consider :—(1) whether each illustration is really necessary and (2) whether blocks if prepared would be used for subsequent articles in the Indian Journal of Agricultural Science when the work is finally published.

(d) The opinion of the Advisory Board is requested on one other point. When illustrations are not printed, it does not seem necessary to have copies of them made for all members of the Advisory Board and it would probably be sufficient if a sufficient number of such charts and photographs were obtained to enable them to be supplied to each member of the Sub-Committee concerned.

APPENDIX XXIII.

NOTE, DATED THE 16TH AUGUST 1934, ON SUBJECT No. 62, APPLICATION FROM THE GOVERNMENT OF BENGAL FOR A GRANT OF RS. 5,000 SPREAD OVER TWO YEARS FOR A SCHEME FOR INVESTIGATING THE BIOLOGY, ANATOMY AND DEVELOPMENT OF PULSE BEETLES (*Bruchidae*), WITH SPECIAL REFERENCE TO REMEDIAL MEASURES AGAINST THESE PESTS BY MR. D. D. MUKHERJI, LECTURER IN ZOOLOGY, UNIVERSITY COLLEGE OF SCIENCE AND TECHNOLOGY, CALCUTTA.

Attention is invited to the attached copy of a letter from the Government of Bengal No. 1, dated the 2nd January 1934 (Annexure I) forwarding the scheme mentioned above (Annexure III). Certain supplementary information which was obtained from Mr. D. D. Mukherji will be found in Annexure IV. The scheme, which involves an expenditure of Rs. 5,000 spread over two years, is now for the consideration of the Advisory Board.

A note on the subject by the Imperial Entomologist, Pusa, is also enclosed (Annexure V).

ANNEXURE I.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BENGAL, AGRICULTURE AND INDUSTRIES DEPARTMENT, CALCUTTA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 1, DATED THE 2ND JANUARY 1934.

Ninth meeting of the Advisory Board of the Imperial Council of Agricultural Research.

With reference to your letter No. F. 6 (1)/33 G., dated the 6th December 1933 (not printed) on the subject mentioned above, I am directed by the Government of Bengal (Ministry of Agriculture) to forward herewith, for inclusion in the Agenda of the meeting of the Advisory Board to be held in February, 1934, the undernoted* scheme, which has been approved by the Provincial Agricultural Research Committee, Bengal, together with relevant extracts (Annexure II) from the minutes of the meeting of the Committee held on December 7, 1933, and to say that the local Government recommend the scheme subject to the condition that no financial liability devolves on them.

ANNEXURE II.

EXTRACTS FROM THE PROCEEDINGS OF THE 7TH MEETING OF THE BENGAL PROVINCIAL AGRICULTURAL RESEARCH COMMITTEE HELD ON 7TH DECEMBER 1933.

* * * * *

Scheme for investigation into the Biology, Anatomy and development of pulse beetles by Mr. D. D. Mukherji, M.Sc., Lecturer in Zoology, Calcutta University.

* (1) Scheme for investigation into the Biology, Anatomy and Development of Pulse Beetles (*Bruchidae*), with special reference to finding out remedial measures against these pests, by Mr. D. D. Mukherji, M.Sc., Lecturer in Zoology, University College of Science and Technology, Calcutta. (Annexure III).

The Scheme was approved by the Committee which recognised its great importance.

At the suggestion of Dr. Ghosh, the term 'Research Scholar' in the estimate was altered to 'Research Assistant'. It was also decided to add (after the words 'for a period of two years') 'and we expect definite results at the end of this period.'

* * * * *

ANNEXURE III.

Scheme for Investigating the Biology, Anatomy and Development of Pulse Beetles (Bruchidae), with Special Reference to Finding out Remedial Measures against these Pests, by D. D. Mukerji, M.Sc., Lecturer in Zoology, University College of Science and Technology, Calcutta.

The small beetles of the Bruchidæ family cause considerable amount of damage to stored pulses. A thorough knowledge of the anatomy, course of development, habit, and bionomics of these insects should be gained before any attempt can be made at finding out remedial measures against these pests. Beyond a little knowledge of the general life-history, nothing much is known of the Indian species. Literature on the subject is scattered. Professor Lefroy and Mr. Bainbrigge Fletcher rightly observed "there is room for work on this family".

Last year I took up working out the anatomy and development of a common species, in collaboration with a research student of this department, who in view of the economic importance of the question, was awarded last year a Research Scholarship tenable for one year by the Government of Bengal. A preliminary report of our work was published in the Abstracts of the Agricultural Section of the Indian Science Congress held in 1933.

The investigation of the anatomical and embryological details of the species alone will keep us occupied at least for two years. In course of rearing the insects in our laboratory for a number of generations, we have felt, however, the importance of extending the observations on other aspects of the problem such as, effect of temperature, moisture and food on the life-cycle, crossing between so-called different species, and the study of the life-history of insect-parasite of the pest, both for the purpose of correlation of facts and adoption of successful control measures. The investigation along the above lines, however, will require the employment of additional research scholars for a period of two years, and we expect definite results at the end of this period.

The Imperial Council of Agricultural Research is approached, therefore, for awarding a research stipend to a scholar of this department to work under my guidance on the Bruchidæ beetles. Permission may easily be had from the University for the use of laboratory instruments and reagents for this investigation. To facilitate the investigation, the Council may be pleased to sanction a grant-in-aid for the purchase of special apparatus and reagents not available in this laboratory.

The scheme set forth here will involve expenditure on the part of the Council as follows :—

	Rs.
Stipend for one Research Assistant for two years at Rs. 150 a month	3,600
Apparatus, Reagents, etc.	1,000
Travelling allowance for field study and collection ..	200
Contingencies	200
Total ..	<u>5,000</u>

The investigation will run on the following lines :—

- (1) Internal anatomy of the adult *Bruchidæ* beetles, particularly of the digestive and reproductive systems.
- (2) Detailed anatomy of the larva.
- (3) Boring and feeding mechanism of the larva.
- (4) Development and metamorphosis.
- (5) Effect of temperature and moisture, and food on the life-cycle.
- (6) Duration of life-cycle in different seasons and rate of multiplication.
- (7) Determination of species affecting leguminosæ crops in India.
- (8) Crossing of different species.
- (9) Habit and behaviour under different conditions of life.
- (10) Estimation of damage done by a pair.
- (11) Life-history of the insect-parasite of the pest.
- (12) Trial of simple control measures.

The subject matter is, of course, in continuation of that in progress. I may mention here that if this proposal finds acceptance, the results are likely to be of great agricultural importance and will form a real contribution to our knowledge of Economic Entomology.

Apparatus.

	Rs.
Constant temperature and humidity insect incubator (Catalogue Sec. No. XXI, Baird & Tatlock) ..	950
Breeding cages	25
Hair hygrometer	25
Total ..	<u>1,000</u>

Contingencies.

	Rs.
(1) Out-fit for collecting insects, Store box, Fine Entomological silver pins, Thermometers, Muslin nets, Glass jars, etc.	200
(2) Chlorodioxide—Essig Saur (for softening Chitin), Clove oil, Cedar Wood oil, Ether, Celloidin, Slides and Cover slips, Stains and other special reagents	
(3) Material (pulse, grains, etc.)	
(4) Extras	

ANNEXURE IV.

LETTER FROM MR. D. D. MUKHERJEE, M.Sc., LECTURER IN ZOOLOGY, UNIVERSITY COLLEGE OF SCIENCE AND TECHNOLOGY, CALCUTTA, TO THE DIRECTOR OF AGRICULTURE, BENGAL, DATED THE 5TH MAY 1934.

I am much thankful to you for your letter No. 15757A/5A/21/34, advising me to quote the literature on the Pulse Beetles (*Bruchidæ*). The list of literature is enclosed. Some of the journals cited in the list are not available in the Calcutta libraries. I believe a complete bibliographical list on the subject was not wanted.

A brief review of a few important papers gives a glimpse of the work done and that remains to be done.

Razzuti's paper (1917, No. 21 in the list) which deals with the general morphology, biology, and life history of the Bruchid Beetle, *Acanthoscelides* was inadequate, as later researches showed. Kunhi Kannan (1919, No. 26-b, in the list) gives a general account of the Indian species. In 1923 (No. 32) he discusses the function of the prothoracic plate of the larva. Therefore, such questions as the cause of the variability of the duration of the life cycle, internal anatomy, etc., were left out of consideration. The author differed in certain points from Chittenden, Lefroy and Fletcher. Brauer (1925, No. 34) confined his attention only to early embryonic development. The intricacy of embryological problem can be realised by a reference to Eastham's paper on the formation of germ layers in insects (1930, No. 49). Daviault (1928, No. 42) touched the post embryonic development, and dwelt on the external morphology of these beetles as well. But he did not go into the anatomical or histological details. Breitenbecher's paper (1926, No. 38) is suggestive of the work that can still be done on the crossing, and tracing of life cycle.

The study of development of the Indian species from egg to adult by serial sectioning of all the stages, had not been attempted before. Neither have I come across with a complete account of the minute anatomy of either the adult, or the larva that causes damage to stored pulses. Previous authors also did not pay sufficient attention to the structural details of the reproductive organ as the criterion for the determination of the limit of the variability of specific characters.

The investigation of the life history and biology of our local specimens of *Bruchidæ*, will be carried on lines followed by Larson (1924, No. 33) and others; and there will be least chance of overlapping of works so far anatomical and embryological details are concerned as these are lacking in previous records.

I can assure you that the scope of investigation suggested will be different from that undertaken by previous workers in India, and is likely to bridge over the gap in our knowledge of these pests.

As no effective remedial measures can be indicated unless all aspects of life of these insects are known, my idea is to bring together all possible data. In view of the wide scope of the subject, it is hazardous to say at this stage that results to be obtained on completion of the investigation, will neither corroborate nor contradict previous authors' observations.

LIST OF LITERATURE.

Bruchidae.

- | | | | | | |
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| *4 | Riley, C. V. | .. | .. | 1892 | The Pea and Bean Weevil.
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| 5 | Do. | .. | .. | 1892 | The first larval stage of the Pea and Bean Weevils.
<i>Cand. Ent.</i> Vol. XXIV, 7, pp. 185, 1892. |
| *6 | Do. | .. | .. | 1893 | On the nomenclature and on the oviposition of the Bean Weevil (<i>Bruchus obtectus</i> Say).
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| 8 | Gain, E. | .. | .. | 1897 | Sur la germination des grains de legumineuses habitees par les Bruches.
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<i>Okla. Agr. Exp. Sta. Bull.</i> Vol. 100, p. 76. |

- | | | | | | |
|-----|------------------------------------|----|----|------|---|
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(Sd.) D. D. MUKHERJI.

ANNEXURE V.

Scheme for investigating the Biology, Anatomy and Development of pulse beetles (Bruchidae), with special reference to finding out remedial measures against these pests by D. D. Mukherji.

The proposed lines of investigation are not all necessary for the trial of remedial measures against Bruchids damaging stored pulses. A great deal of what is proposed has already been done as far as their usefulness towards trial of control measures goes.

The protection of stored pulses from insects has received a great deal of attention and at present the need is for more direct experiments regarding methods for keeping the stored pulses safe from infection.

The investigation of insect pests of stored grains is one of the subjects engaging the attention of the Imperial Entomologist as may be seen from the annual reports of the Pusa Entomological Section.

Available information goes to show that for devising protective measures for saving stored grains from infection by pests a general knowledge of the habits of the injurious insects is quite sufficient and the urgent need is for improving the methods of storage.

P. C. ISAAC,

Offg. Imperial Entomologist.

The 15th August 1934.

APPENDIX XXIV.

NOTE, DATED THE 18TH AUGUST, 1934, ON SUBJECT No. 63, ADOPTION OF MEASURES TO PREVENT THE FURTHER SPREAD OF SAN JOSE SCALE, A SERIOUS FRUIT PEST IN INDIA.

At its meeting held in August 1933, the sub-committee which considered the North-West Frontier Province Entomological Survey Scheme emphasised the urgency of taking all possible measures to prevent the further spread of San Jose Scale, *vide* pages 282-283 of the printed proceedings of the Board's meeting. The report of the Committee was adopted by the Board (Pages 35-36 of the proceedings). The attention of all Local Governments and the Baluchistan Administration was drawn to the serious character of this pest and to the need for the introduction of suitable quarantine arrangements to prevent its further spread (Annexure I). The replies which have been received from Local Governments and Administrations will be found in Annexure II.

2. It will be seen that the Governments of Bombay, Bengal, Burma, Bihar and Orissa and Assam state that the pest is not known to exist in their Provinces. The Government of Madras would prefer an amendment of the Destructive Insects and Pests Act, 1934, to provincial legislation. The pest is not known to exist in the United Provinces and the possibility of introducing legislation to prevent imports from the affected areas to the hill areas of the United Provinces is being considered by the Local Government. The Punjab Government are considering the introduction of legislation with a view to prohibit its export of plants from areas already known to be affected. In the Central Provinces the entomologist is making investigations to trace the insect in the plateau and hill districts of the Province and any action required to prevent the spread of the infection from any local sources will be taken by the Local Government on the report of the Entomologist. There are places in Baluchistan where San Jose Scale has made its appearance and that Administration would desire as far as possible, to conform generally to such measures as may be found practicable in the North-West Frontier Province.

The subject is now for the consideration of the Advisory Board.

ANNEXURE I.

LETTER FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO ALL LOCAL GOVERNMENTS AND THE SECRETARY TO THE AGENT TO THE GOVERNOR-GENERAL, BALUCHISTAN, No. F-114/33-A., DATED THE 24TH JANUARY 1934.

I am directed to address the Government of Madras, etc. regarding the adoption of measures to prevent the further spread of San Jose Scale (*Aspidiotus Perniciosus*), a serious fruit pest in India.

2. On the occasion of the meeting of the Advisory Board of the Council held at Simla in August 1933 an application from the Government of the North-West Frontier Province for a grant for an entomological survey scheme in that province was considered by a special Sub-Committee composed as follows :—

1. Mr. B. C. Burt, Agricultural Expert and then also officiating Vice-Chairman, Imperial Council of Agricultural Research.

2. Mr. Afzal Husain, Principal, Agricultural College, Lyallpur and Entomologist, Punjab.
3. Mr. P. V. Isaac, officiating Imperial Entomologist, Pusa.
4. Mr. P. B. Richards, Entomologist, United Provinces.
5. Nawabzada Sadatullah Khan, Agricultural Officer, North-West Frontier Province.

In the course of its deliberations the committee was impressed by the extent to which the dreaded San Jose Scale (*Aspidiotus Perniciosus*), a most serious pest of fruit trees in other countries, had already become established in India. In the report, a copy of which is attached (Pages 282-283 of the printed proceedings of the Advisory Board, August 1933) the committee emphasised the urgency of taking all possible measures to control and confine the local attacks, thus preventing the further spread of this pest. It was considered necessary, in the interests both of the non-affected areas in the invaded provinces and of other fruit-growing areas in India, to check its spread by prohibiting export from affected areas and by other means. The committee recommended that all known infected areas should immediately be put into strict quarantine.

3. The report was adopted by the Advisory Board and in the course of the discussion it was pointed out that it was essential in the interests of the rest of India that the traffic in infected plants should be put a stop to immediately. For the protection of orchards in the rest of India and those parts of the Punjab which had not yet been affected, it was considered necessary that internal quarantine regulations should be made restricting the export of plants from the affected areas. It was also stated that until such time as it was known whether particular orchards were or were not affected, the export of plants from all suspected areas should be stopped.

4. I am accordingly to invite the attention of the Government of Madras, etc., to the serious character of this pest and to the need for the introduction of suitable quarantine arrangements to prevent its further spread. I am to request that any action, which the Government of Madras, etc., the Local Administration may decide to take in this connection may, if there is no objection, kindly be communicated to this Department for information.

5. In this connection I am also to enclose for the information of the Local Government [Local Administration] a copy (with 2 spare copies) of the Plant and Crop Protection Regulation No. 1 of 1930 (not printed) promulgated by the Government of His Highness the Maharaja of Jammu and Kashmir and a notification issued under the Regulation declaring *inter alia* San Jose Scale to be an insect pest.

ANNEXURE II.

I

LETTER FROM THE OFFICIATING SECRETARY TO GOVERNMENT, EDUCATION AND DEVELOPMENT DEPARTMENT, GOVERNMENT OF BIHAR AND ORISSA, No. 558-D., DATED THE 23RD FEBRUARY 1934.

With reference to your letter No. F-114/33-A., dated the 24th January 1934 (Annexure I), I am directed by the Government of Bihar and

Orissa (Ministry of Education) to say that San Jose Scale is a very serious pest of fruit trees, but fortunately at present it is non-existent in Bihar and Orissa. As strict quarantine measures are necessary against importation of stock from infected areas in other parts of India, I am to request that if there be no objection, the local Government may be furnished with a list of such areas to enable them to consider the necessity for introducing quarantine regulations.

II

LETTER FROM SECRETARY TO THE GOVERNMENT OF ASSAM, TRANSFERRED DEPARTMENTS, No. 711-E., DATED SHILLONG, THE 22ND MARCH 1934.

I am directed to acknowledge the receipt of your letter No. F-114/33-A., dated the 24th January 1934 (Annexure I), on the subject of adoption of measures to prevent the further spread of San Jose Scale (*Aspidiotus Perniciosus*), a serious fruit pest in India.

In reply I am to say that this Government propose to take no action in this connection, as this province is not yet affected by this pest.

III

LETTER FROM REVENUE SECRETARY TO GOVERNMENT, CENTRAL PROVINCES, No. 457/141-XIV, DATED NAGPUR, THE 12TH APRIL 1934.

With reference to your letter No. F-114/33-A., dated the 24th January 1934 (Annexure I), I am directed by the Government of the Central Provinces (Ministry of Agriculture) to say that so far no reports of the prevalence of San Jose Scale in these provinces have been received. The local Entomologist will, however, make investigation to trace the insect in the plateau and hill districts of this province where it is likely to find a congenial soil. The question of taking any measures for dealing with the spread of the infection from any local sources can be taken up only after these investigations are completed. In the meanwhile the local Government considers that the import into this province of infected nursery stock scions, or fruits from the infected North Western areas should be checked by the adoption of the measures suggested by the local Entomologist in the last paragraph of his note a copy of which is herewith enclosed.

2. In the opinion of the local Government the most effective way of dealing with the evil would be to prohibit the export of nursery stocks, scions and fruits from infected areas without an authenticated certificate of fumigation issued by the local authorities of the infected provinces. Some system or organisation for checking such imports into the horticultural areas of this province may also be necessary and in order to ensure it, the Director of Agriculture has been asked to make detailed proposals regarding this after the investigation of the Entomologist.

Note on San Jose Scale (Aspidiotus Perniciosus) by the Entomologist to Government, Central Provinces.

San Jose Scale (*Aspidiotus Perniciosus*) is one of those insects in which I am specially interested. It was to investigate this insect in the

Kashmir valley, in 1923, that I was placed on a special deputation along with Mr. Bainbridge Fletcher, the late Imperial Entomologist. Consequently I happen to know a good deal about this dreaded insect, and am fully alive to the immense amount of damage which this small tiny insect is capable of causing to fruit trees.

This insect thrives best in hill stations and attacks most of the fruit trees grown there, *e.g.*, Apple, Pear, Peach, Plum, Cherry, Quince, etc. It is very doubtful that the insect will be able to establish itself anywhere in the plains of the Central Provinces, where during April—May the temperature goes up to anything like 118°F. or more. But places like Chhindwara, Pachmarhi, and Chikalda will have to be carefully guarded.

The insect is found on all parts of the affected trees, on the trunk, branches, shoots, leaves and fruits. On badly infested trees it sometimes completely covers the bark and appears of greyish colour to the naked eye, and imparts a greasy feeling to the bark. When present on fruits it causes a little discolouration—a reddish mark around the scale. The males of this species are winged, the females never develop wings and remain attached to the food plant till they die. The young are born alive under the scale of the female and crawl about for a few hours, and on finding a suitable place for feeding they insert their beak into the bark or skin and feed on the liquid they obtain from the plant or fruit by sucking. They secrete a waxy material which covers their body, and this waxy covering is called the 'Scale'.

It will be seen from the above that it is only during the few hours of larval activity that the insect can spread either on the same tree or from tree to tree. This migration may be active or passive; active when the larvae walk about and get to the different limbs of the same tree or to other trees when their branches interlace with the affected one; passive, when the young larvae are carried to other trees on the feet of other birds, or body of other insects or possibly by wind. But its spread from one town to another town, from one province to another province, from one country to another country is mainly due to the importation of infested nursery stock or scions. Attacked fruits may also be responsible to a certain extent, only under certain conditions. For instance, I have seen on several occasions *Amari* variety of Kashmir apples and Kullu apples infested with this scale offered for sale in the local market; still this pest is not known to exist in or about Nagpur—The reason is simple; those who take the fruit without peeling kill the insects in their stomach, and those who peel them throw the peels in the dust bin or allow them to lie about where they get dried and the insects on them, failing to get sap, die of starvation. If from some peels active larvae happen to emerge they fail to find a suitable food-plant to thrive on, but should any succeed these are sure to be killed when hot winds blow during April—May. The case will be different in a place like Pachmarhi, Chhindwara or Chikalda where suitable trees for the insect exist and hot winds do not blow. If Kashmir and Kullu apples are imported into these places also, and a party of friends arrange to have a picnic in a fruit garden, and throw apple peels bearing this dreaded scale insect in close proximity to any of the fruit trees which serve it as a food-plant, and further the peels unfortunately bear a few female scales from which the young larvae are just crawling out, there is a possibility—a remote one of course—of the pest getting established there. Since this pest has not so far been reported

from these hill stations, it must be due to lack of this peculiar combination of circumstances detailed above, or it may be that infested fruits have not so far found their way up there. But importing nursery stock or scions from infested gardens, is the most direct method of introducing the pest into localities which are so far free from it.

The pest is definitely known to exist in the Kashmir valley, Kullu valley (Punjab), Kotgarh near Simla Hills, and the N.-W. F. Province. I am not sure if its existence in the gardens of Kumaon Hills (U. P.), but I should not be surprised to find it there also.

The cheapest and the most effective method to kill this pest on nursery stock, scions and fruits is fumigation with Hydrocyanic Acid Gas which can be done at the exporting or importing station. In the Central Provinces, I can do it at Nagpur, provided all consignments are received here in the first instance. These will be unpacked, fumigated, re-packed and forwarded to their respective destinations. This will, of course, mean some extra expense to the importers as they will have to pay extra freight, etc. For instance a man ordering apple stock from Kashmir for Pachmarhi shall have to pay Railway freight from Itarsi to Nagpur and back, plus repacking charges. The only other way is to build fumigating chambers at each of the three hill stations and engage necessary staff there. This will be very expensive to Government. In my opinion, therefore, it should be made obligatory on the exporters to fumigate the consignments before despatch. It will be to their interest, as people desirous of obtaining fruits or fruit stock from these infected places will always place orders with them, knowing that they can get stock or fruit absolutely free from insects.

My suggestions in the matter have been made clear in the above paragraphs, and I summarise them now below :—

- (i) the Government of India may be requested to notify as early as possible the names of localities which at present are known to be definitely infected.
- (ii) No nursery stock or scion should be obtained from these localities unless the same has been fumigated there with HCN gas before despatch.
- (iii) An officer of the Agricultural Department of the province (preferably an Entomologist) in which the infected nursery is situated should certify that the fumigation has been satisfactorily carried out, and his certificate should accompany the consignment.
- (iv) Till the Government of India announces by a notification the names of infected areas, no nursery stock or scion be obtained from Kashmir valley, Kullu valley, Kotgarh and N.-W. F. Province for any garden situated within the limits of the Central Provinces.
- (v) Fruits like apples, pears, plums, peaches, quinces, and cherries (the last named fruit is too delicate to travel long distances) may not be imported directly or indirectly* into Pachmarhi.

* (NOTE.—Indirect mode of importing will be importing first in Nagpur or any station in the plains and thence forwarding to any of three hill stations mentioned above.)

Chhindwara and Chikalda from places mentioned in the last paragraph, unless the fruit packages are fumigated by the exporters before despatch.

G. R. DUTT,
Entomologist, C. P.

IV

LETTER FROM SECRETARY TO THE HONOURABLE THE AGENT TO THE GOVERNOR-GENERAL AND CHIEF COMMISSIONER IN BALUCHISTAN, No. 1515/R., DATED QUETTA, THE 17TH APRIL 1934.

Your letter No. F. 114/33-A., dated the 24th January 1934 (Annexure I) has been the subject of careful attention. Baluchistan, as you are aware, is an area in which fruit growing is likely to be of great and increasing future importance. It is also the route by which a very large traffic in fruit passes from Afghanistan (Kandahar) to India. There are places in Baluchistan in which the San Jos Scale has made its appearance. The pest is also probably established in the Kandahar area. In this and in other matters the position in Baluchistan is closely analogous to the position in the North-West Frontier Province. The main difference is that, while the area of Baluchistan is greater than that of the North-West Frontier Province, its population and financial resources are much less. While therefore the Baluchistan Administration would desire so far as possible to conform generally to such measures as may be found practicable in the North-West Frontier Province, it is obviously difficult for Baluchistan to go further than the North-West Frontier Province. The Baluchistan Administration would therefore be much interested to be informed what steps are being taken in the North-West Frontier Province, and, in particular, whether the entomological survey contemplated for the North-West Frontier Province is being sanctioned. It seems probable that the activities of a survey established for the North-West Frontier Province might without any considerable difficulty or expense be extended to Baluchistan.

A copy of this letter is being sent to the Director of Agriculture and Allied Departments, North-West Frontier Province, Peshawar.

V

LETTER FROM SECRETARY TO GOVERNMENT, UNITED PROVINCES, No. 466, DATED ALLAHABAD, THE 28TH APRIL 1934.

In reply to your letter No. F. 114/33-A., dated January 24, 1934 (Annexure I), I am directed to say that enquiries show that the San Jose pest is not at present found in the United Provinces, and hence there is no question of prohibiting exports from any part of the United Provinces.

2. It is realised however that there is a serious danger of this pest entering the United Provinces and from the area to the north-west of the province, and it is necessary for that area to take steps to prevent exports from there to the hill areas of the United Provinces. The possibility of introducing legislation to prevent imports from the affected areas to the

hill areas of the United Provinces is being considered and in the meantime the attention of the owners of orchards in the hill areas of the United Provinces is being drawn to the advisability of refusing by voluntary agreement to import garden and nursery stock from the Punjab, North-West Frontier Provinces and adjoining States.

3. This Government may kindly be informed in due course as to what portion of that area is infested and what action has been taken for prohibiting exports from those areas to the United Provinces.

VI

LETTER FROM DEPUTY SECRETARY TO GOVERNMENT, PUNJAB, DEVELOPMENT DEPARTMENT, No. 1888-D., DATED LAHORE, THE 5TH MAY 1934.

In reply to your letter No. F. 114/33-A., dated 24th January 1934 (Annexure I), I am directed by the Punjab Government (Ministry of Agriculture) to forward, herewith, for information, a copy of letter No. 3260, dated 27th February 1934, from the Director of Agriculture, Punjab.

2. The ministry is considering the introduction of legislation with a view to prohibit the export of plants from areas already known to be infected.

COPY OF A LETTER FROM THE DIRECTOR OF AGRICULTURE, PUNJAB, TO THE DEPUTY SECRETARY TO GOVERNMENT, PUNJAB, DEVELOPMENT DEPARTMENT, No. 3260, DATED THE 27TH FEBRUARY 1934.

SUBJECT :—*Adoption of measures to prevent the further spread of San Jose Scale (Aspidiotus Perniciosus), a serious fruit pest in India.*

With reference to your endorsement No. 487-D., dated 17th February 1934, I have the honour to state that the necessity for imposing restrictions on the movements of fruit and fruit trees from areas in the Punjab already known to be infested with San Jose Scale was emphasised at the meeting of the Advisory Board of the Imperial Council of Agricultural Research held in August 1933. At that meeting I gave an account of the successful measures which the Punjab Agricultural Department had already taken to deal with this pest in regions where the pest had been discovered, and informed the Board that, in accordance with our proposal to take active measures to deal with this particular pest, Government sanctioned the appointment of two whole-time Agricultural Assistants, four Mukaddams and four Fieldmen for work on fruit pests in 1928. In the meantime this staff has undertaken a large campaign of spraying to eradicate the pest and these measures have met with considerable success, as is evidenced by the letters of appreciation received by the Department from fruit growers in Kulu and the Simla Hills where the pest was discovered.

2. The Advisory Board, however, did not consider that the work already in progress was sufficient and emphasised the necessity for introducing quarantine regulations against those localities where the pest exists in the province. It is evident that, before any quarantine regulations can be introduced, the first essential is to discover the exact localities in the

province where this pest exists. We know that it does exist in Kulu and the Simla Hills, but it is only comparatively recently that we have found it as low down as Kalka. Whether it is present at lower heights and in the plains generally is still unknown. I carefully considered the capacity of the present staff of the Department to undertake a survey of the province in order to obtain the required information and in consultation with the Entomologist I decided that it was impossible for the Department's existing staff to carry out the survey within any reasonable period. I, therefore, drew up a scheme to survey the province. This scheme covered a period of three years at a cost of Rs. 35,052. The province was to be divided into four sectors. The existing staff working on San Jose Scale would do the survey in one sector, but for the other three additional staff was required. This scheme was considered by the Provincial Council of Research in December, 1933 and was laid before the Advisory Board of the Imperial Council of Agricultural Research at its meeting in February 1934. The Advisory Board approved of the scheme, but reduced its duration from three to two years and its cost from Rs. 35,052 to Rs. 22,512, and has recommended it for the final sanction of the Governing Body. It is understood that the next meeting of the Governing Body will be held in October 1934 and, as soon as funds are allotted, the survey will be taken in hand. When the infested areas are known, the question of eradicating the pest within those areas and, if necessary of introducing quarantine regulations, until the pest is eradicated, will be considered.

VII

LETTER FROM OFFICIATING SECRETARY TO THE GOVERNMENT OF BENGAL, AGRICULTURE AND INDUSTRIES DEPARTMENT, No. 106-T.A.I., DATED DARJEELING, THE 7TH MAY 1934.

With reference to your letter No. F. 114/33-A., dated the 24th January 1934 (Annexure I), I am directed to say that the pest has not so far been observed in the fruit-growing areas of this province. A special survey is, however, being undertaken by the Entomological Assistant of the Provincial Agricultural Department for the purpose of ascertaining whether the areas are entirely free from infection. The local Government await the result of this survey and will take any action that may be shown to be required.

VIII

LETTER FROM ASSISTANT SECRETARY TO THE GOVERNMENT OF BENGAL, AGRICULTURE AND INDUSTRIES DEPARTMENT, No. 3768, DATED THE 10TH AUGUST 1934.

In continuation of this Department letter No. 106-T.A.I., dated the 7th May 1934 (Serial No. VII), I am directed to say that as it has been ascertained from the special survey undertaken by the Entomological Assistant of the Provincial Agricultural Department, that the fruit-growing areas of Darjeeling and Sikkim are free from the pest, it is not proposed to take any measures for the prevention of the spread of San Jose Scale in Bengal.

IX

LETTER FROM SECRETARY, GOVERNMENT OF BURMA, FOREST DEPARTMENT,
No. 74-O., DATED RANGOON, THE 7TH MAY 1934.

With reference to your letter No. F. 114/33-A., dated the 24th January 1934 (Annexure I), I am directed to forward, for information, a copy of letter No. 2773/1-E-1, dated the 28th April 1934, from the Director of Agriculture, Burma, and to say that the Government of Burma agree with the opinion expressed by the Director of Agriculture, Burma.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, BURMA, TO THE
SECRETARY TO THE GOVERNMENT OF BURMA, FOREST DEPARTMENT
No. 2773/1-E-1, DATED THE 28TH APRIL 1934.

SUBJECT :—*Adoption of measures to prevent the further spread of San Jose Scale (Aspidiotus Perniciosus), a serious fruit pest in India.*

With reference to your endorsement No. 74-O., dated the 12th February 1934, I have the honour to state that I have consulted the Entomologist in the matter and discussed it with him. It would appear that in America where the San Jose Scale has been very thoroughly studied injury is confined to orchard trees such as peach, pear, Japanese plum, apple and quince while cherry and European plum are less injured. In Japan it occurs also on persimmon, citrus, deciduous trees, walnut and birch, and in Kashmir in addition to the above plants the recorded list of host plants include currants, berries, cydonia japonica, flowering prune, figs and willows. The insect is accordingly an orchard pest and is not known to occur on ordinary field crops. None of the plants which it attacks are of importance in this province except probably oranges. At present, however, the orange growing tracts are beyond the reach of importations from India. The Entomologist is of the opinion, which I share, that measures proposed to be taken to prevent its spread from the infested area must aim either at stopping export altogether or at the fumigation of plants or parts of plants before export in order to be effective at all. Hence I conclude that the interests of this province will be safeguarded by the measures adopted at the source of infection and that for the present local measures are not required.

X

LETTER FROM SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT
DEPARTMENT, No. 510-III/34-2, DATED THE 23RD MAY 1934.

With reference to your letter No. F-114/33-A., dated 24th January 1934 (Annexure I), I am to state that parcels of fruit are received almost throughout the year in Southern India both by post and by railway from the Punjab. The Director of Agriculture, Madras, considers that there are certainly possibilities of the San Jose Scale pest being distributed to different parts of South India and that it would be desirable to impose restrictions on the importation of fruit, etc., from affected areas. It is also understood that this insect has a world-wide distribution and is found in the New World, Australia, China and Japan and that there are possibilities of the insect being imported from Australia from which country consignments of fruits are frequently received in South India. It would be necessary in these cases to

insist on a strict quarantine and a thorough examination at the ports of entry by competent officers to prevent the import of the pest into India. This can be enforced by the Government of India under the Destructive Insects and Pests Act II of 1914 and it is hoped that the Council will bring the fact to the notice of the Government of India. I am, however, to point out that under paragraph 3 of the rules issued in Notification No. 580-240, dated 22nd June 1922 by the Government of India in the late Department of Revenue and Agriculture, an exception has been made in regard to fruits and vegetables intended for consumption. It is necessary that such consignments should also be subjected to a thorough examination ; but some device other than fumigation will have to be adopted to sterilise imported fruits and vegetables intended for consumption.

2. As there is a danger of the pest being imported into British India from overseas especially from Australia and as the precautions to be taken against the spread of the pest in India are of all-India importance, I am to state that it would be expedient for the Government of India to take steps to provide against the spread of the pest. I am to suggest that, as the pest has already found its way into Northern India, the Destructive Insects and Pests Act II of 1914 should be amended so that the pest may be dealt with under that Act and the movement of infected fruits, vegetables and plants from one place in India to another prevented. This would be a more effective method of combating the spread of the pest throughout India than the attempt of each Province to resort to legislation on its own account.

XI

LETTER FROM THE ACTING SECRETARY TO THE GOVERNMENT OF BOMBAY,
REVENUE DEPARTMENT, No. 1871-A.133, DATED BOMBAY CASTLE, THE 7TH
JUNE 1934.

With reference to your letter No. F.114-33-A., dated 24th January 1934 (Annexure I), I am directed by the Government of Bombay (Transferred Departments) to state that the 'San Jose Scale' is not known in the Presidency proper. As far as can be ascertained the disease is not known to be a serious pest in Sind also. In this connection, I am to forward for your information copies of the correspondence noted below and to state that the Government of Bombay are generally in agreement with the views expressed by the Chief Agricultural Officer in Sind. I am to add that they do not propose to take at present any measures for the introduction of quarantine arrangements :—

Memorandum from the Chief Agricultural Officer in Sind, No. S.-45, dated 17th March 1934.

Letter from the Director of Agriculture, No. S-56-A.1742, dated 17th May 1934.

COPY OF MEMORANDUM FROM THE CHIEF AGRICULTURAL OFFICER IN SIND,
No. S.-45, DATED THE 16TH/17TH MARCH 1934.

SUBJECT :—*Adoption of measures to prevent the spread of San Jose Scale (Aspidiotus Perniciosus) fruit pest in India.*

The Chief Agricultural Officer in Sind presents compliments to the Under Secretary to the Government of Bombay, Revenue Department,

and, with reference to his endorsement No. 1871-A.133, dated 1st February 1934, forwarding copies of letter from the Secretary, Imperial Council of Agricultural Research, No. F.114-33-A., dated 24th January 1934, and its accompaniments on the above-noted subject, has the honour to state as under.

As far as can be ascertained, the San Jose Scale is not known to be a serious pest on fruit trees in Sind but whether this pest actually exists in Sind or not cannot be determined finally until a survey of the fruit-growing areas in Sind is carried out by a trained entomologist. At the recent meeting of the Advisory Board of the Imperial Council of Agricultural Research, an application was considered from the Government of the Punjab for a grant of Rs. 35,052, spread over a period of three years, for a San Jose Scale survey in the Punjab. The Chief Agricultural Officer in Sind, in supporting the application, urged strongly that the work should not be confined to the Punjab but that Sind should also come within the scope of the survey as little, if any, additional cost would be incurred thereby. The Advisory Board approved the inclusion of Sind in the survey and the Vice-President (Sir T. Vijayaraghavacharya, Kt.) promised to examine the scheme with the object of extending the work to cover the fruit-growing areas in Sind as well as the Punjab. In the opinion of the Chief Agricultural Officer in Sind, such a survey is required at an early date in Sind, to take place simultaneously with similar surveys in the Punjab and the North-West Frontier Province, and the Government of India should be requested to issue the necessary orders for the prevention of exports of seedling fruit trees, stocks, etc., from such areas as may be found to be infected with the pest in these provinces unless adequate measures for sterilization of despatch from such quarantine tracts. In the meantime, areas definitely known to be infected should be subjected to quarantine restrictions on exports of live fruit trees to other parts of India on the lines indicated above.

The findings of the special sub-committee, appointed by the Imperial Council of Agricultural Research to consider the application received from the Government of the North-West Frontier Province for an entomological survey scheme in that province emphasise the necessity for an entomological and mycological section of the local Agricultural Department in Sind, in which connection, the Chief Agricultural Officer in Sind desires to invite the attention of Government to paragraph 29 ("Crop Pest Section") of the Scheme for the completion of the equipment of the Agricultural Research Station, Sakrand, submitted under this office letter No. 399 of 1933, dated 9th November 1933.

COPY OF THE LETTER FROM THE DIRECTOR OF AGRICULTURE, No. S-56-A.1742,
DATED THE 17TH MAY 1934.

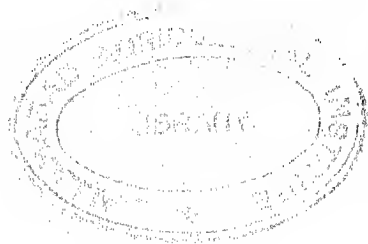
SUBJECT :—*Adoption of measures to prevent the further spread of San Jose Scale (Aspidiotus Perniciosus), a serious fruit pest in India.*

With reference to papers sent me with Government endorsement, No. 1871-A.133, of February 1st, 1934, Revenue Department, I have the honour to remark that the San Jose Scale is not known in the Bombay

Presidency. There is, therefore, no need for any particular quarantine regulations with regard to fruit plants sent out from this Presidency.

2. The only possible source of infection which we might have to watch is the import of apples into Bombay from other countries. I have no information whether the San Jose Scale has been observed on any such consignments; but I am asking the Professor of Entomology to take this matter up and make arrangements to see some consignments arriving in Bombay. Should the San Jose Scale be found, I may make further representations to Government regarding measures which it may be necessary to take. Should any Government assistance be required in order to gain access to apple shipments arriving in Bombay, I shall make the necessary requisitions.

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SUPPLEMENTARY NOTE, DATED THE 31ST AUGUST 1934, ON SUBJECT No. 63,
ADOPTION OF MEASURES TO PREVENT THE FURTHER SPREAD OF SAN
JOSE SCALE, A SERIOUS FRUIT PEST IN INDIA.

In continuation of the Note, dated the 18th August 1934, already circulated on the subject mentioned above, a copy of a letter (and enclosure) from the Government of the Central Provinces, No. 972/826-XIV, dated the 23rd August 1934, is attached for the consideration of the Advisory Board.

COPY OF LETTER FROM THE REVENUE SECRETARY TO GOVERNMENT, CENTRAL PROVINCES, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 972/826-XIV, DATED THE 23RD AUGUST 1934.

SUBJECT :—*Adoption of measures to prevent the further spread of San Jose Scale (Aspidiotus Perniciosus), a serious fruit pest in India.*

In continuation of this department's letter No. 457/181/XIV, dated the 12th April 1934, on the subject noted above, I am directed by the Government of the Central Provinces (Ministry of Agriculture) to forward herewith, for the information of the Research Council, a copy of a memorandum No. 3471, dated the 14th August 1934, from the Director of Agriculture, Central Provinces, and to say that the local Government concurs in the view expressed by the Director therein.

COPY OF MEMORANDUM FROM THE DIRECTOR OF AGRICULTURE, C. P., TO THE REVENUE SECRETARY TO GOVERNMENT, CENTRAL PROVINCES, NAGPUR, No. 3471, DATED THE 14TH AUGUST 1934.

Reference :—Correspondence resting with this office memo. No. 2668, dated the 4th July 1934, regarding San Jose Scale on fruit trees.

It will be difficult to check the import into the Plateau Districts of fruits like apples, pears, etc., which carry the San Jose Scale, unless the Railway Company co-operates by giving some authorized person intimation when a consignment of fruit arrives. This would necessarily entail delay in delivery until inspection was made, which might amount to several days, especially if the examiner were away from Headquarters. Each Railway Station in the area would have to report and it would be impossible for the examiner to visit small stations away from his Headquarters except at considerable expense to Government. Prohibition of import by road from within the Province would be impossible. For these reasons I consider that action should be taken from the other end. Railway companies should be compelled by law to refuse acceptance of consignments coming from notified infected areas unless accompanied by a license or certificate of freedom from the pest. A license of import is required in the case of cotton entering an area protected under the Cotton Transport Act and there is no reason why a restriction of similar nature should not be applied in the case under discussion. The number of Railway stations in the Punjab, etc., from which fruit is despatched is so few that the system suggested cannot fail to achieve the object in view.

APPENDIX XXV.

Report of the Sub-Committee appointed to consider Rice Research Schemes.

PRESENT :

Diwan Bahadur Sir T. Vijayaraghavaacharya (*Chairman*).

Professor S. P. Agharkar.

Dr. W. Burns.

Mr. B. C. Burt.

Mr. M. Carbery.

Professor R. H. Dastur.

Dr. J. C. Ghosh.

Dr. V. N. Likhite.

Mr. A. M. Livingstone.

Mr. A. McKerral.

Professor P. K. Parija.

Mr. S. V. Ramamurthy.

Mr. P. B. Richards.

Mr. J. R. Ritchie.

Mr. D. R. Sethi.

Dr. F. J. F. Shaw.

Mr. M. Vaidyanathan.

Rao Bahadur B. Vishwanath.

The Sub-Committee met on the afternoon of September 3rd, 1934.

1. Consideration of the Progress Reports on the Rice Research Schemes in Madras, the United Provinces and Central Provinces (Subject No. 23 of the Agenda), was postponed until the next meeting of the Advisory Board as the reports had not been received from the press.

2. *Application from the Government of Bengal for a grant of Rs. 43,152 spread over three years for a Scheme of research work on the Physiology of the rice plant by Dr. S. P. Agharkar of the Calcutta University.* (Subject No. 24 of the Agenda) (Appendix XXVI).—The Sub-Committee, after the revised scheme had been fully explained by Prof. Agharkar, decided, in the first place, that the second part of the proposed investigation 'Studies on the inter-relation of factors controlling the growth and development of different varieties of rice' should not be undertaken at present (this decision was unanimous). The question whether Part I only of the scheme should be undertaken was then considered in detail. By a majority, the Sub-Committee decided that the proposed investigation on the 'Water Relations of the Rice Plant' should *not* be sanctioned. It was pointed out that a considerable amount of information on this subject was available at the various rice research stations and that if further work were needed, direct field experiments would yield results more quickly than the proposed research, the results

of which would be very difficult to interpret. The minority considered that any more information on the water requirements of the Rice Plant would be valuable and that the Scheme should be sanctioned.

3. *Scheme from the Government of Madras for an investigation into the quality of rice.* (Subject No. 28 of the Agenda). (Appendix XXVII).—The Agricultural Expert reported that certain details which were lacking when the proposal was last considered, had now been furnished. The scheme involved no additional grant but merely the transfer of an Assistant from the Rice Research Farm to Bangalore. The proposal fitted in with the corresponding scheme at the Indian Institute of Science to which funds had now been allotted. The Sub-Committee recommends that the scheme be sanctioned. It desires to draw attention to the importance of more information on the relation between chemical composition and the 'commercial' quality of rice.

4. *Progress report for the year 1933-34 on the scheme of research work on rice physiology by Dr. R. H. Dastur, Royal Institute of Science, Bombay.* (Subject No. 29 of the Agenda). (Appendix XXVIII).—Professor Dastur, having explained the work in progress and answered questions, the report was approved. The Sub-Committee desires to draw attention to the fact that a practical result, viz., the superiority of a mixture of Ammonium sulphate and Sodium nitrate to either constituent as a fertiliser for rice on some soils, has emerged from a purely physiological investigation. It is suggested that agricultural departments may find it worth while to test this conclusion over a wider range of conditions. Some detailed suggestions regarding the presentation of data in future reports (notably the sizes of individual plots) were accepted by Professor Dastur.

5. *Application from the Government of Bengal for a grant of Rs. 21,600 spread over five years for a scheme of research on the bio-chemical and physico-chemical properties of rice at the Bio-Chemical laboratory of the Dacca University.* (Subject No. 30 of the Agenda). (Appendix XXIX).—This scheme was postponed at the last meeting of the Committee in order to obtain particulars of work in progress and the opinion of General Sir Robert McCarrison, I.M.S., on the proposals. After a very full discussion of the Scheme the Sub-Committee agreed :—

- (i) that the proposals for nutrition experiments involving the use of animals which were to have been carried out at the Calcutta School of Tropical Medicine should be dropped ;
- (ii) that the work on the physico-chemical properties of rice should be undertaken—special attention being paid to the relation between physical characters, chemical composition and quality ; and
- (iii) that the proposed work on the Enzyme hydrolysis of rice should be undertaken. The question whether one Research Assistant would be sufficient, was considered. In view of the large amount of material which the Bengal Agricultural Department can provide, it was considered that two assistants would be needed.

All laboratory expenses in connection with this scheme are being met by the Dacca University, the Council's grant being

sought for research assistants only. The Sub Committee recommends that the grant of Rs. 21,600 spread over 5 years be sanctioned.

6. *Scheme from the Government of Bihar and Orissa for research on the quality of rice.* (Subject No. 31 of the Agenda). (Appendix XXX).—The Sub-Committee considers that items 1 (c) and 1 (d) in the proposed programme of work on this scheme should be omitted, at least until some results have been obtained from the corresponding Dacca Scheme (Appendix XXIX). The staff proposed would also be inadequate if these items were included. The non-recurring grant can, in consequence, be reduced by Rs. 750. The Sub-Committee recommends a grant of Rs. 7,740 spread over three years.

7. *Application from the Government of the Central Provinces for a grant of Rs. 10,088 spread over four years for research work on the 'gangai' pest of rice—Entomological work under the scheme of rice research already sanctioned by the Council for the Central Provinces.* (Subject No. 32 of the Agenda). (Appendix XXXI).—The Sub-Committee considers that this problem should be undertaken by the Entomological Section of the Imperial Institute of Agricultural Research especially as one officer of the section is a specialist in Diptera. The Sub-Committee suggests that the Director of the Imperial Institute of Agricultural Research should put before the Council a proposal for any small financial assistance necessary. It is hoped that it will be possible to consider this before the Advisory Board adjourns.

B. C. BURT.

4th August 1934.

APPENDIX XXVI.

NOTE, DATED THE 30TH JULY 1934, ON SUBJECT No. 24, APPLICATION FROM THE GOVERNMENT OF BENGAL FOR A GRANT OF RS. 43,152 SPREAD OVER THREE YEARS FOR A SCHEME OF RESEARCH WORK ON THE PHYSIOLOGY OF THE RICE PLANT BY DR. S. P. AGHARKAR OF THE CALCUTTA UNIVERSITY.

At its meeting held in February 1934 the Advisory Board considered an application (not printed) from the Government of Bengal for a grant for research work on the physiology of the rice plant by Dr. Agharkar, and it was agreed that the scheme should be withdrawn for reconsideration in the light of the recommendations made by the rice sub-committee (Annexure I). The Government of Bengal were informed accordingly.

2. Attention is now invited to the attached letter from the Government of Bengal, No. 3166, dated the 30th June 1934 (Annexure II), forwarding a revised scheme (Enclosure to Annexure II). The revised scheme involves an expenditure of Rs. 43,152 spread over a period of three years.

3. The Vice-Chairman to the Council considers that it will be an advantage to have the present scheme examined by the Committee of the Council which examined the original scheme and which consisted of the following gentlemen :—

1. The Vice-Chairman, Imperial Council of Agricultural Research (Chairman).
 2. The Agricultural Expert, Imperial Council of Agricultural Research.
 3. The Director of Agriculture, Madras.
 4. The Director of Agriculture, Bombay.
 5. The Director of Agriculture, Bengal.
 6. The Director of Agriculture, United Provinces.
 7. The Director of Agriculture, Bihar and Orissa.
 8. The Director, Imperial Institute of Agricultural Research, Pusa.
 9. Professor J. C. Ghosh.
 10. Rao Bahadur B. Viswa Nath.
 11. Professor P. K. Parija, Ravenshaw College, Cuttaek.
 12. Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.
 13. Professor S. P. Agharkar, Calcutta University.
- Rai Sahib Malik Charan Das, Secretary, *ex-officio*.

4. It may be added that the Committee is being invited to consider the following points especially :—

(a) Whether, and if so to what extent, items 1 (i) and 1 (ii) of the second part of the proposed investigation "Studies on the inter-relation of factors controlling the growth and development of different varieties of rice" overlap the investigations already in progress in connection with the under-mentioned schemes already sanctioned by the Council :

- I. Research work on Rice Physiology by Professor R. H. Dastur ;
- II. Scheme of research work on the nutrition of the rice plant by Professor Ghosh (Dacca University).

(b) (i) How far the study of the water contents of the various parts of the plant, the distribution of dry weight in various parts of the plant and the chemical composition in the various parts of the plant will really throw material light on the main problems of the investigation.

(ii) Whether it is worth undertaking this portion of the programme, even from a purely scientific point of view, since in dealing with vegetable matter of non-uniform composition, the number of analyses carried out must be sufficient to justify statistical handling of the data.

5. Certain supplementary information has been asked for from the Director of Agriculture, Bengal, regarding part 'B' of the scheme which will be circulated, on receipt.

6. The Committee will meet on an afternoon between the 3rd and the 8th of September 1934 which will be fixed later to meet the convenience of members of the Board. Its report will be submitted to the Board in due course.

ANNEXURE I.

EXTRACT FROM THE REPORT OF THE RICE SUB-COMMITTEE, FEBRUARY 1934.

Application from the Government of Bengal for a grant of Rs. 20,812 for a scheme of research on the physiology of the rice plant.

Professor Agharkar explained the scheme to the Committee in detail. It was the opinion of the Committee that some of the work proposed has already been carried out either in India or in other countries whilst some of the other problems mentioned are now being studied in India. On the other hand there are a number of points connected with the physiology of the rice plant which require further study, e.g., the reason why the application of soluble manures at certain stages of growth leads to marked increases of yield and the reasons underlying the necessity for un-watering rice fields at a certain stage in the growth of the crop and the replacement of the standing water by fresh water—a practice which is common in Bihar and Orissa and some other irrigated rice areas. It was agreed that the scheme should be withdrawn for reconsideration.

ANNEXURE II.

COPY OF A LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BENGAL, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 3166, DATED THE 30TH JUNE 1934.

SUBJECT :—*Scheme for research work on the physiology of the rice plant by Professor S. P. Agharkar of the Calcutta University.*

I am directed to refer to your letter No. F. 49/34-Agri., dated the 16th April 1934 (not printed), on the subject mentioned above, and to forward herewith, in continuation of this Department letter No. 123-T.A.L., dated the 12th May 1934 (not printed), a revised scheme (enclosure), approved by the Bengal Provincial Agricultural Research Committee, for inclusion in the agenda of the meeting of the Advisory Board to be held in September 1934. I am to say that the Government of Bengal (Ministry of Agriculture) recommend the adoption of the scheme on the condition that no financial liability devolves on them.

Enclosure.

A Scheme for Research Work on the Physiology of the Rice Plant.

By Prof. S. P. Agharkar of the Calcutta University.

Introduction.

Various problems regarding the cultivation of rice have been a subject of scientific investigation for many years and valuable information is now available as a result of researches in India and other countries. More recently several schemes regarding these problems have been put into operation under the direction of the Imperial Council of Agricultural Research in various parts of India.

Of the factors more directly influencing the growth and nutrition of the rice plant, nitrogen has received considerable attention of both the earlier and present workers. The availability of nitrogen in the soil and its application as manure present a complicated study. At present the Dacca University Agricultural Research workers are studying the supply of nitrogen in the soil and its relationship to the growth and development of the plant. They are also studying the general food requirements of the rice plant. Prof. R. H. Dastur in Bombay has been studying the problems connected with the use of nitrogen fertilisers (Appendix I). He has also directed his attention to the study of physiological process (photo-synthesis, respiration, transpiration, etc.), which is essential for the real understanding in the relationships of external conditions to the internal processes.

Manuring experiments are in progress at various research stations, e.g., at Berhampore (Ganjam). But the works at these stations are more on agricultural lines.

In Bengal rice is cultivated in a variety of fields. Some are several feet under water during the growing period of the plant, others are situated at higher levels where rainfall is comparatively low and irrigation a necessity, and there are many intermediate conditions between these extremes. Work on the selection of types to suit these varied conditions is in progress but the physiological significance of the adaptation of the plant to various water-conditions does not seem to have received enough systematic investigation. Owing to the semi-aquatic nature of rice, water requirements demand special attention throughout its life-history, including the preparation of the soil for sowing and transplantation. This has been very aptly illustrated by the experience of the rice research workers at Chinsura Farm during the last two years. In 1932, the rainfall was normal both in total quantity and distribution. In the previous year (1932) failed to tiller after transplanation and did against a normal of 10.56-in.), of which 7.28-in. was recorded on the 24th June 1933. The experimental fields were flooded to a depth of more than one foot of water in consequence at the time of the transplanation. Owing to continued rainfall during the rest of the season, the level of water did not fall to any material extent. Under these abnormal conditions, the Patnai selected strains which had done well in the previous year (1932) failed to tiller after transplanation and did not recover from the initial set back. The crop was thus practically a failure.

From enquiries made among cultivators, it was ascertained that under such circumstances they delayed transplantation although the seedlings became too old for the purpose. They believe that excessive standing water in the field at the time of transplantation hinders tillering and think it better to get some crop by delaying transplantation than transplant at the usual time and run the risk of complete crop failure.

It has been noticed that water-logging in the field hinders the normal development of the tillers.

It is also the practice in some parts of Bihar and Orissa and other irrigated areas to de-water the rice fields at certain stages of the crop and to replace the standing water by fresh water. The change of water may be necessary for the aeration of the submerged parts of the plant and for the proper development of the soil micro-flora. It may also be that the substances dissolved in the water have some effect on the growth of the plant and replenishing their supply with fresh water is useful. The possibility of development of harmful organisms in the standing water may as well be taken into account.

Apart from the studies of the nature of the food-requirements of the rice plant intensive work on the inter-relation of the nutrient elements (the relation of one particular factor to others at varying levels of one another) in their bearing on other factors controlling the yield under different conditions, has not yet been taken up to the desired extent.

It is known from experience with barley, that the number of tillers and maximum leaf area are proportional to the nitrogen given but increase in nitrogen does not increase the rate of assimilation (3) in contradiction with potassium which increases the efficiency of the leaf. The weight of individual grain is independent of the level of nitrogen provided the other factors (e.g., K_2O , etc.) are available in proportional amount and further that excess of potassium has little effect on the grain-weight at any level of nitrogen whereas a deficiency of potassium below a level proportional to the nitrogen greatly reduces the grain-weight (5-d). In this connection, reference may be made to the work of F. C. Gregory and his collaborators (Appendices 2, 3, 4 and 5) on cotton in the Sudan and at Rothamsted Experimental Station.

On the basis of the knowledge already obtained, studies of the inter-action of soil, water, climatic and nutrient conditions may be made to elucidate factors limiting the yield of rice, so that suitable technique could be developed to grow rice under conditions of drought, different depths of water, fertile and unfertile soils, etc., with profit.

Investigations proposed.—In view of the necessity of a further elucidation of the problems of rice cultivation, as pointed out above, it is proposed to undertake the following investigations :—

1. The water relations of the rice plant under different conditions to determine the optimum water requirements and the critical stages of watering.

In order to determine these, it is proposed to investigate (i) the scientific significance of the practice of growing different varieties of

rice in varying depths of water in the field, (ii) the inter-relation of the level of water in the field and the stage of development of the plant. Water-logging in the field is reported to suppress the normal development of tillers and later tillers in rice are generally not available for increasing the yield of grains. In this connection the inter-action of the level of water in the field and the stage of growth of the plant may be best avoided to prevent the production of later tillers. In practice the depth of water in the field at a certain stage of the plant may be directly controlled in irrigated areas, and in other localities adjusted by the time of sowing or transplanting, (iii) the relationship of the plants to substances dissolved in the water, e.g., Oxygen, nutrient elements, etc.

The technique employed will be to grow plants of different varieties (a) in pots under varying conditions of soil moisture and humidity, and (b) in specially constructed tanks containing different depths of water. The relationship of the plants to substances dissolved in the water may be studied (1) by varying the degree of aeration both by blowing air and replacing the standing water by fresh water at intervals, and (2) by adding mineral nutrients in definite quantities to the water. The growth of organisms in the water will also be taken into account.

2. Studies on the inter-relation of factors controlling the growth and development of different varieties of rice.

(I) (a) The inter-action of the levels of nutrient elements and the stage of the plant to investigate the reason why the application of soluble manures like ammonium sulphate and sodium nitrate, at certain stages of growth leads to marked increase.

(b) The effect of the inter-action of nutrient elements N , K_2O , P_2O_5 on the growth and water relation of the plant and also its probable varietal response.

The results of these studies will lead to the determination of (i) the best period for the supply or starvation of nutrient substances, as well as (ii) the balanced conditions of N , K_2O , P_2O_5 and water at various levels of their supply. Taking spacing into consideration, the weight of a single grain, yield per unit area and the cost of production (seed-rate, irrigation, manure, labour, etc.) under the prevailing conditions will determine the ultimate efficiency of a balanced level of factors for a certain type of paddy.

The results of this investigation will be of immense value for areas where soil fertility is low and irrigation is the main source of water-supply.

In connection with these studies the problems of rice transplantation will be investigated to determine (i) the factors producing the optimum number of tillers, as well as (ii) the most favourable period for transplanting in single and double crop fields with reference to conditions in Bengal. Considering that in cereals, e.g., barley, rice, etc., the early stages of growth are those of rapid uptake of nitrogen and other nutrient substances and also that rice is grown under the most favourable conditions in the early stages and then transplanted, the possibility of manuring the plant in seed-beds with profit in less fertile localities,

will be borne in mind. In this connection (iii) a study of the varietal differences in the utilisation of the various food constituents would afford a surer basis for selection purposes and furnish data for a deeper consideration of the transplantation problems.

In order to understand thoroughly the significance of the various processes involved in response to the considerations under investigation, the physiological behaviour of the plant will be studied at various stages of growth, as evidenced in (I) the morphological features of the plant :—

- (i) the laying down of new meristematic regions measured by the rate of production of tillers ;
 - (ii) the rate of development of the successive parts measured by the rate of production of leaves ;
 - (iii) the potentialities of successive primordia measured by the area of successive leaves and the final length of inter-nodes ;
 - (iv) the time of onset of the reproductive phase measured by the time of immergence of the ears ; and
 - (v) the fertility of the plants in relation to vegetative growth measured by ear-number, flower number and fertility of flowers.
- (II) Water contents of the various parts of the plant.
- (III) (a) total dry weight of the plant ; and
(b) distribution of dry weight in various parts of the plant.
- (IV) The chemical composition of the various parts of the plant.
- (V) The total assimilation rates.

The behaviour of the different varieties will be expressed in quantitative terms so that their performances can be accurately compared.

The scientific part of the work will be done under the general supervision of the Ghose Professor of Botany in the Botanical Laboratory of the Calcutta University and the garden attached to it, where facilities for general work in plant physiology exist. The laboratory is further equipped with all necessary apparatus for systematic, morphological, ecological and cytological work and has a good reference library attached to it. Instruments for recording the various climatological factors are also available. The University authorities are prepared to allow these facilities to be used for the proposed scheme and will also meet the cost of ordinary chemicals, gas and electricity. In addition the Calcutta University has sanctioned a special non-recurring grant of Rs. 1,200 for necessary preliminary work in connection with this scheme, which has already been started.

It will, however, be necessary to appoint a special research fellow with necessary training in plant physiological research and a research assistant to work under him as additional staff for this purpose.

It will also be necessary to provide some special apparatus and a pot culture house in connection with the scheme ; provision for travelling in connection with the field work and for necessary contingent expenses will have to be made.

For field work in connection with this investigation the Bengal Agriculture Department is prepared to provide an area of 4 acres of high land at the Chinsura Farm. This land will have to be levelled properly and necessary irrigation facilities provided. A non-recurring grant of Rs. 1,500 for the levelling and Rs. 500 for pumping arrangements will have to be provided.

An assistant in Subordinate Agricultural Service (Class I) and a fieldman will also have to be provided for the purpose.

The field work at Chinsura will be under the direct control of the Economic Botanist, Bengal, who is also in charge of the rice research work being done there.

The formulation and detailed working out of the problems will be done by the University staff in collaboration with the staff of the Agricultural Department.

The probable total expenditure, non-recurring and recurring is given below---

A. Recurring (University Staff).

	1st year.	2nd year.	3rd year.
	Rs.	Rs.	Rs.
(1) Plant physiologist ..	3,000	3,300	3,600
(2) Research Assistant (Rs. 140—10—200) ..	1,680	1,800	1,920
(3) Laboratory boy (Rs. 15 —1—20)	180	192	204
(4) Mali (Rs. 15—1—20) ..	180	192	204
(5) Travelling allowance ..	750	750	750
(6) Chemical and contingencies ..	500	500	500
	<hr/> 6,290	<hr/> 6,734 ..	<hr/> 7,178
		Total ..	20,202

A. Non-recurring (University).

	Rs.
(1) Pot-culture house with pots, etc.	1,500
(2) Eight cemented tanks 10 ft. \times 7 ft. \times 2 ft. 6 in. each	500
(3) Apparatus	500
	<hr/> 2,500
Grand Total ..	<hr/> 22,702

B.—Recurring (at Chinsura) for three years.

	1st year.	2nd year.	3rd year.
	Rs.	Rs.	Rs.
(1) 1 assistant in subordinate agricultural service at Rs. 140—10—160 ..	1,680	1,800	1,920
(2) 1 Fieldman at Rs. 50 per mensem ..	600	600	600
(3) Contingencies ..	3,600	3,600	3,600
(4) Travelling expenses ..	150	150	150
	<hr/>	<hr/>	<hr/>
	6,030	6,150	6,270
	<hr/>	<hr/>	<hr/>
	Total	..	18,450

B.—Non-recurring (at Chinsura) for three years.

			Rs.
(1) For levelling fields, etc. ..	..	..	1,500
(2) For pumping sets, etc. ..	..	..	500
			<hr/>
	Total	..	2,000
			<hr/>
	Grand Total	..	20,450

Summary of the problems to be investigated.—(1) Experiments on the water relations of the rice plant to determine (i) its optimum water requirements, (ii) the critical stages of watering, and (iii) the scientific significance of the practice (in some irrigated areas) of de-watering the rice field at certain stages of growth and replacing the standing water by fresh water at intervals.

(2) Investigation of the inter-relation of factors controlling the yield of rice, (i) to elucidate why the application of soluble manures at certain stages of growth leads to marked increase and to determine, (ii) the best periods for the supply or starvation of N, K, O & P₂O₅, and (iii) the balanced conditions of factors, e.g., N, K, O, P₂O₅ and water, for the maximum yield of different varieties of rice, at various levels of their supply so that by selecting the strain and the adjustment of spacing even less fertile relatively drier localities may be made to yield good crops of rice.

APPENDIX.

(1) Dastur, R. H., and Malkani, T. J.—The Intake of Nitrogen by the Rice Plant. Ind. Journ. Agri. Sc., Vol. III, p. 157, April, 1933.

(2) Gregory, F. G., Growther, F., and Lambert, A. R.—The Interrelation of Factors controlling the Production of Cotton under Irrigation in the Sudan. *Jr. Agri. Sc.*, 1932, 22, pp. 617—638.

(3) Gregory, F. G.—The Effect of Climatic Conditions on the growth of Barley. *Ann. Bot.* Vol. XI, pp. 1—26, 1926.

(4) Gregory, F. G., and Growther, F.—A Physiological Study of Varietal Differences in Plants, Part I. *Ann. Bot.* Vol. XLII, p. 757, July 1928.

(5) Gregory, F. G., and Collaborators—Physiological Studies in Plant Nutrition ; (a) Part I, *Ann. Bot.* Vol. XLIII, p. 119, January 1929. (b) Part II, *Ann. Bot.* Vol. XLIV, p. 147, 1930. (c) Part III, *Ann. Bot.* Vol. XLVI, p. 367, 1932. (d) Inter-relation of Nitrogen and Potassium in the growth of Barley. Thesis submitted by R. N. Mathur for Ph.D. (Lond.) in June, 1933.

APPENDIX XXVI-A.

SUPPLEMENTARY NOTE, DATED THE 20TH AUGUST, 1934, ON SUBJECT No. 24, APPLICATION FROM THE GOVERNMENT OF BENGAL FOR A GRANT OF RS. 43,152 SPREAD OVER 3 YEARS FOR A SCHEME OF RESEARCH WORK IN THE PHYSIOLOGY OF THE RICE PLANT BY DR. S. P. AGHARKAR OF THE CALCUTTA UNIVERSITY.

The following letter from the Economic Botanist to the Government of Bengal gives the additional information referred to in para. 5 of the note dated the 30th July 1934 already circulated to the Advisory Board on the above subject.

LETTER FROM THE ECONOMIC BOTANIST TO THE GOVERNMENT OF BENGAL, TO THE DIRECTOR OF AGRICULTURE, BENGAL, No. 1540/78, DATED THE 10TH AUGUST 1934.

* * * * *

With reference to Mr. Burt's demi-official No. F. 49/34[A., dated the 21st July, 1934, I have the honour to state that the Part "B" of the scheme (in the work to be carried out at the Chinsurah Rice Research Station) will form an integral part of Prof. Agharkar's scheme.

Experiments conducted at the University will be in pots mainly under Laboratory conditions in order to elucidate the precise nature of the relationship of the Rice plant to conditions as indicated in the scheme.

Field experiments will be necessary to extend the university work on proper agricultural basis and to test the practical utility of the results obtained. This will also enable an investigation being carried out regarding introduction of possible improvement of the present method of cultivation used by agriculturists.

It is well-known that in many parts of Bengal it is necessary to regulate the water supply during the critical stages of development of the plant either by irrigation or by drainage. Under the conditions obtained in Bengal there are some practical difficulties in arranging for these. An investigation of the problems involved becomes, therefore, a matter of considerable importance and urgency and has been provided for in the scheme submitted. The results will be of great value in investigating problems concerning the large area of double cropped lands of the province. At present the cultivators in such areas grow only late Aman varieties as a second crop, which do not yield return commensurate with the labour and expenses involved. Field work on the inter-action of different water conditions, stage of growth of plant and varietal differences will show whether it will be possible to replace these by suitable types yielding greater profits on the whole.

A rough outline of work proposed to be undertaken under Part "B" is given below :—

- (a) Different depths of water will be maintained in the fields throughout the life-cycle of the paddy plants.
- (b) Fields will be watered and dewatered regularly at intervals of two weeks, four weeks and six weeks throughout the life-cycle of the plant.

(c) Water will be applied at critical stages in the life-cycle of the plant—

- (1) at the time of cessation of tillering ;
- (2) at Thormikh stage (i.e., about a week before the immergence of the inflorescence) ;
- (3) at the grain setting stage.

This will form in all six or seven treatments each with its proper number of replications. The experiments will be conducted on as many selected early, medium and late varieties as will be practicable on the available area. Materials, from the various plots will be used for the study, in the Laboratory of the inter-action of factors controlling the growth and developments of the different varieties of rice. The actual working details of the layout, etc., will be determined later on. An estimate has, however, been formed that an area of about 4 acres will be necessary for the experiment.

It is not possible for the present staff at Chinsurah to undertake this additional work. It has therefore been proposed to appoint additional staff located at Chinsurah for the purpose. As it will not be possible for the University staff (Prof. Agharkar or the Plant Physiologist) to exercise constant supervision over their work, it is proposed to vest the administrative control over them to the Economic Botanist Bengal who is already in charge of a Rice Research scheme at the station. As this part of the work involves a considerable knowledge of field conditions, the detailed programme of the work will be settled jointly by Prof. Agharkar and the Economic Botanist, Bengal.

The scheme proposed is thus a good example of co-operation between the Calcutta University and the Department of Agriculture, Bengal.

Details of contingent expenditure required for Part " B " of the scheme are furnished below :—

Heads.	Amounts.	Remarks.
	Rs.	
1. Labour	1,700	The estimated cost of labour is necessarily high on account of the fact that we have (1) to deal here with an irrigation experiment necessitating continuous employment of labour to maintain water at defined levels, (2) to keep the bunds in proper order, and (3) to employ a band of literate labour for recording all adequate data that will be necessary for the purpose.
2. Chemicals and apparatus ..	500	
3. Seeds, plants, manures and implements.	300	
4. Miscellaneous contingencies ..	600	
5. Irrigation requisites and repairs ..	500	
Total ..	3,600	

APPENDIX XXVII.

NOTE, DATED THE 4TH AUGUST 1934, ON SUBJECT No. 28, SCHEME FROM THE GOVERNMENT OF MADRAS FOR INVESTIGATION INTO THE QUALITY OF RICE.

At its last meeting the Advisory Board and the Committee on rice research schemes considered the proposals from the Madras Agricultural Department for investigation into the quality of rice. The recommendation of the Committee was that this scheme in common with the Bengal scheme, should be referred to General McCarrison for opinion. The Madras scheme was not put forward definitely as a request for a grant and no financial details had been received. The Director of Agriculture, Madras, subsequently explained that what was intended was to divert one Assistant from the current Madras rice research scheme (for which four Assistants are provided) in order that an Assistant might be available for work at Bangalore on the quality of rice. It may be noted here that, in making proposals for the scheme of work on the quality of crops (which has been sanctioned and to which funds have been allotted this year), the Professor of Bio-Chemistry at the Indian Institute of Science referred to the work which had been in progress since 1928 in collaboration with the Paddy Specialist, Madras, on this question of quality.

The attached note, Annexure I (letter No. 290/33 of 19th February 1934 from the Paddy Specialist to the Director of Agriculture, Madras), explains the two parts of the proposal. The first part will consist of (a) a study of the differences in the structure of rice grain of some important varieties and (b) the effect of different methods of storing on quality. This work will be carried out at Coimbatore under the Paddy Specialist with his present staff.

The second part of the investigation, *viz.*, the correlation of chemical composition of the grain of different varieties and the changes in composition during storage it is proposed to carry out at Bangalore.

When the Paddy Specialist's note was written, the position was that the Bangalore scheme for work on the quality of crops had been sanctioned but funds had not been allotted. Funds have now been allotted to that scheme which is for two years and provides for a Bio-Chemist and for a small allowance for contingencies, the cost of the scheme being Rs. 2,560 in the first year, and Rs. 2,840 in the second year.

A copy of the Bangalore Scheme (as sanctioned) is attached for ready reference, Annexure II. It is now clear that the Madras proposals fit in quite well with the scheme sanctioned at the Indian Institute of Science and do not overlap in any way with the Bengal scheme which will be under consideration at this meeting.

There would appear to be no objection to granting permission for the utilisation of one of the posts sanctioned in connection with the Madras main rice research scheme for special work on the quality of rice to be carried out under the Professor of Bio-Chemistry, Bangalore. Rice in Madras is grown almost entirely for local consumption so that the question of quality and nutritive value is of great importance, and it is obviously desirable that no risk should be run of introducing new strains which, though higher yielders, are of lower quality.

ANNEXURE I.

LETTER FROM THE DIRECTOR OF AGRICULTURE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, THROUGH THE SECRETARY TO GOVERNMENT, DEVELOPMENT DEPARTMENT, No. D. 1101/33, DATED MADRAS, THE 22ND AUGUST 1933.

[Investigations into the quality of rice—Scheme for.]

I have the honour to enclose a copy of paragraphs 1 to 7 of the scheme drawn up by the Paddy Specialist for undertaking investigations into the quality of rice.

2. The importance of the work, and how it will form a useful and valuable adjunct to the research work on breeding for higher yields, has been clearly explained by the Paddy Specialist.

3. The staff required for the scheme is an assistant and a fieldman, specially earmarked for the work for a period of three years. The assistant will have to work mostly at Bangalore in order to deal with the chemical and nutritional studies for which facilities exist at Bangalore. The problem of storage and the histological studies on the bran layer of the rice grain, will be tackled at Coimbatore.

4. As regards financing of the scheme, I request that sanction may be accorded for taking up the investigations as it forms a very valuable part of the research work on rice, and permit me to meet the expenditure from the sanctioned grant for the Rice Research Station, Berhampur. There is provision for the appointment, this year, of an assistant and a fieldman for this station. The Paddy Specialist proposes to put them on to the investigations into the quality of rice.

5. The assistant to be employed at Bangalore may be permitted to draw the pay of Rs. 120—10—170 as in the case of the assistants sanctioned for the Berhampur station. The fieldman will be started in the new scale of Rs. 30—3|2—48.

6. As the Paddy Specialist is anxious to start the investigations immediately, I request the favour of early sanction.

ENCLOSURES.

(1)

Note on investigation in the quality of rice.

Rice is the staple food of the majority of the people in the province and there are definite indications to the effect that people in the rural parts—as for instance in Coimbatore district—are now increasingly taking to rice diet. The attempts of the breeder has all the time been concentrated on improving the yield and no work has so far been done to improve the quality with special reference to human nutrition. In the west breeding for higher yields goes hand in hand with breeding for improvement in quality. A thorough knowledge about the variations in the nutritive properties of rice is very essential so that armed with this knowledge the breeder can attempt to combine higher yields with quality or better nutritive value.

2. The work of McCarrison and others has shown that the main nutritional principles in rice is vitamin B-1 and that the bran contains

most of this principle which is almost wholly removed by the milling and polishing processes before it comes to the consumer. It has been found in this section that varietal differences exist in the thickness of this bran layer. It is quite possible that varietal variations exist as regards their nutritive value. It is generally believed that short duration rices are poorer in quality than the long duration ones. Though evidence exists to warrant such belief, a scientific explanation is wanting. Similarly it is considered that red rice is more nutritious than white rice. This has to be verified, and, if it is real, we have to determine whether this difference is related to the thickness of the bran layer. Even the rices raised in different methods of cultivation vary from their nutritive point of view as is seen from the results of McCarrison's experiments on rices sent from Pattambi grown under dry and wet conditions. The wet crop found to be poorer in nutritive value.

3. Secondly par-boiled rice is generally considered more nutritious than raw rice, though a scientific explanation is wanting to warrant this statement. What the effect of par-boiling is on the chemical composition and the nutritive value of rice has to be determined by following the nature of bio-chemical changes undergone by the grain during the process of par-boiling. This should be studied particularly in the case of fresh unstored grain as it is believed that par-boiling very definitely eliminates the digestive disorders caused by using raw rice from the same source. The nature of the transformations undergone by the proteins of rice during par-boiling and the extent to which that treatment enriches the husked rices have also to be determined. The influence of par-boiling on the vitamin contents, particularly of B-1 and B-2 of the grain, have to be investigated and conditions determined for the maximum conservation of those constituents in the finished product. It has been suggested recently that the better nutritive value of par-boiled rice is due to the diffusion of the vitamin B-1 from the outer layers into the endosperm during the par-boiling process.

4. Thirdly, the question of storage and its effect on the quality and nutritive value of rice requires investigation. Raw rice prepared from fresh paddy immediately after harvest not only gives a highly gelatinized preparation on cooking but also leads to diarrhoea and other digestive disorders, if used continuously. Apart from the difficulty in husking fresh paddy without breakage, the quantity of cooked rice is very much less in the case of fresh grain than in the case of grain stored for some time. The only way of satisfactorily using freshly harvested grain is to prepare par-boiled rice out of it. The nature of the chemical changes taking place during storage and also the significance of such changes in relation to the nutritive value of rice prepared out of them would require careful scientific study, and whether such changes can be accelerated or retarded by the different methods of storing obtaining in the country requires investigation. The period and method of storage adopted with fresh grain before it can be made suitable for consumption vary considerably and there are apparently varietal differences. The problem of storage involves physiological investigations on the respiration and respiration products during storage.

5. Lastly rice varieties differ with regard to their texture and they may be classified as hard and soft. Most of the Madras rices with a few

exceptions (G.E.B. 24 is one) have to be classified as soft when compared to the North Indian rice like Patna which are all hard. There is no doubt that hard rice are superior in quality and obtain better prices in the market. While the genetics of this character is already under study, the chemical and nutritional differences, if any, between the hard and soft rice require investigations. In this study the glutinous rice also should come in as they form an intermediate group between the hard and soft rice. The hardness and softness has a definite relationship to the milling qualities of the grain as the hard rice are easier to mill without breakage.

6. I have discussed the details of the investigations with the Professor of Bio-Chemistry at the Indian Institute of Science, Bangalore, and a comprehensive scheme of work has been drawn up. While the histological studies on the bran layer of the rice grain will be continued at Coimbatore, the chemical and nutritional studies will have to be done in Bangalore where expert guidance and unlimited facilities already exist. The problem of storage will also be tackled in Coimbatore and the necessary standard materials for the experiments, raw and par-boiled, fresh and stored rice, etc., will be supplied from Coimbatore.

7. The successful carrying out of the investigations would involve the appointment of an assistant and a fieldman specially earmarked for the work for a period of at least three years. A suitable assistant with the necessary qualifications to undertake the investigations is available in the section and he can learn the necessary technique after a few months' stay in Bangalore.

(2)

Studies on 'quality in rice'.

Programme of Research.

I. *Effect of par-boiling on the chemical composition and nutritive value of rice.*—(A) (i) Starting from fresh (unstored) grains of the same standard varieties of paddy (to be chosen by the Paddy Specialist) raw and par-boiled rice would be prepared according to recognized methods. The bran and husk to be carefully separated in each case, dried and stored for subsequent examination.

(ii) *Preliminary chemical examination of the different products.*—Examination of ether and alcohol solubles, analysis for starch according to Davis and Daith or any other standard method, total nitrogen and minerals.

(iii) In view of the importance of nitrogen distribution in the study, analysis should be conducted under the following heads, viz., general division into :—

- (1) water soluble,
- (2) salt soluble,
- (3) alcohol soluble,
- (4) alkali soluble, and
- (5) coagulable and non-coagulable fractions

after previous peptization of the nitrogenous compounds by alkali.

(B) Detailed distribution of nitrogen either in the whole material or in the different fractions according to any recognized method of examination—Van Slyke, Dakin, Kossel or other methods.

Examination of the above data with special reference to the determination of the mechanism of nitrogen transformations during parboiling. Direct experiments have also to be conducted studying the effect of heating the grain with water on different forms of nitrogen at various stages. Addition of water or salt extractable proteins to raw rice and studying the effect thereof on the mode of cooking standing storage under water and other properties which distinguish parboiled rice from raw rice. The object of this experiment will of course be to reconstruct the changes attendant on the process of parboiling by actual demonstration of the changes by adding the nitrogenous extractives to raw rice.

II. *Relative growth promoting qualities of raw and parboiled rice from the same grain.*—These experiments are to be carried out with albinos for general growth and with birds for polyneuritis. Since it is probable that the constituents distinguishing parboiled rice from raw rice would be mainly nitrogenous in character, it is suggested that the animal experiments should be carried out by substituting the basal supply of casein with cooked *dal* to stimulate the conditions prevailing in the East particularly Indian homes. It is not however to be inferred that the removal of casein is expected to make any difference with regard to the development of polyneuritis. It is only hoped that the difference in nutritive value arising from the coagulated nitrogen of parboiled rice would become evident when other rich and more concentrated forms are not supplied together with it. The animals thus fed would receive food *ad libitum* together with the cooked vegetables. In addition to the experimental animals, a set of control animals receiving the standard basal diet with wheat-chapati, milk, green vegetables, etc., would also be maintained. The experimental animals would not receive any butter, but a calculated amount of bazaar ghee would be added to their diet.

As since distinct from polished raw rice, parboiled and polished rice is said to contain vitamin B, some experiments are also to be conducted to test the observation. Some colorimetric studies according to Spruyt's method are also to be made and the results correlated with those of feeding experiments.

III. *The effect of storage on rice.*—(i) Chemical examination of rice and bran prepared out of grains of a standard variety (the specimens to be supplied by the Paddy Specialist) stored for varying lengths of time. In addition to the general preliminary examination, a detailed analysis will be conducted with reference to the transformations attendant on the different carbohydrates and nitrogenous compounds, during storage. The effect of such changes on the products obtained after cooking should also be determined. Physical measurements such as viscosity might also be usefully employed for determining changes in the composition of the products obtained on boiling.

(ii) In view of the perceptible difference in the extent of gelatinization starch when the grain or rice stored for different periods of time is cooked, some experiments should be carried out under *in vitro* conditions to determine the extent of hydrolysis of the product thus obtained by the action of different digestive ferments. Since even unstored rice loses its

undesirable qualities on being parboiled, the observations should be extended to that preparation as well.

(iii) Animal experiments should next be taken up, the details of work being similar to those outlined for the previous research. The studies could be conducted concurrently with those of the previous series if sufficient number of animals are available.

To begin with two standard methods of storing rice will be taken up for investigation. In connexion with this investigation, some respiration experiments with stored grains will be undertaken, in Coimbatore, the nature and quantity of gases evolved determined from time to time.

IV. *Effect of duration of crop, the 'Quality' of rice.*—In view of the large number of varieties of grain that are available for this work, it is suggested that in the earlier stages, researches for the present be confined to two varieties only—one of about three months' duration and popularly believed to be not very wholesome and the other of at least six months' duration and generally believed to be nutritious.

The details of the chemical examination of the two varieties would be similar to those outlined for parboiled rice. Since it is not improbable, however, that there may be some fundamental difference with regard to the distribution of nitrogen in the proteins associated with the two varieties, special attention would be paid to this aspect of the research. In this connexion, it is pointed out that the earlier research of Rosenheim and Kajiura and a few others would require to be checked by the improved present-day methods.

Special attention will also be paid to the distribution of minerals in the ash which also constitute factors in determining nutritive values of the grains, a short duration crop having probably less mineral matter to draw upon during the period of growth than one of long duration.

The relative vitamin B contents are also to be compared first by Spruyt's colorimetric method and if necessary checked by subsequent feeding experiments. The general growth promoting values are also to be evaluated according to methods already described.

V. *The origin and nature of certain special characteristics in rice, their bearing on the nutritive value of the grain, colour, scent, hardness, glutinous character and such other attributes.*—In the case of coloured rices, the chemical examination will be extended to the isolation, identification and determination of their nutritive value of such of the colouring materials and such other constituents as are associated with them.

In the case of scented rices, the identity of the volatile constituent as also its concentration will be determined. There is evidence to suggest that the presence of scent in rice is an inherited quality.

The nature of the constituents that determine the hardness or otherwise of rice would also call for special attention particularly with regard to the make-up of the amylose and amylo-pectin fractions of starch. The mode of association of nitrogen with the grain would also come in for careful study.

It is believed that the glutinous rice is rich in dextrins. Since degradation products of starch and dextrin as well as the soluble forms

of starch are degradation forms from the more developed polysaccharides it would be of interest to follow the transition in the chemical make-up of the starches from the hard, soft and glutinous rice and to determine the mechanism of the evaluation of the one from the other.

Further researches on the above and related characteristic constituents would depend on the results of the preliminary chemical examination of such other materials as also from such other information as can be collected from the popular experience regarding the actual usage of such grains.

(3)

LETTER FROM THE PADDY SPECIALIST, COIMBATORE, R. O. C. No. 290/33,
DATED 19TH FEBRUARY 1934.

[Scheme for investigations into the quality of rice.]

No details were given in my proposal about the cost of the investigation as the idea is to utilize the staff and funds already provided for the Ganjam scheme which is financed by the Imperial Council of Agricultural Research. I consider that Ganjam rices all belong to the fine types, commonly believed to be of better quality, and so the investigation could form a useful adjunct to the breeding work carried on at the Ganjam station. This station is, according to the scheme approved by the Imperial Council of Agricultural Research, to have ultimately four assistants and three fieldmen. Three assistants and three fieldmen have already been appointed. The programme of work at Berhampur will be so adjusted as to spare the fourth assistant for the investigation on the quality of rice.

The investigation outlined consists of two parts. The first is to study the differences in the structure of rice grain of some important varieties and also to adopt different methods of storing grain commonly practised in South India and to observe the differences brought about in the quality of grain by such storing. This part of the work will thus mainly consist of histological and physiological studies and will be undertaken at Coimbatore under my supervision with the help of my present staff at Coimbatore. The second part of the investigation is to correlate these studies with the chemical composition of the grain and the changes undergoing in such composition during the storage. It is this second part that will give us a clue to the quality and the nutritive properties of the grain as relating to its structure and method of storage adopted. Necessary feeding trials will also have to be undertaken along with the chemical investigations. This portion of the work is certainly outside the scope of my experience and the scheme relating thereto is entirely that of the Professor of Bio-Chemistry at the Indian Institute of Science, Bangalore. I have discussed the question with him and he considered that it could be undertaken at Bangalore under his supervision if an assistant were to be appointed specially for it. It is true no doubt that one assistant will not be able to cope with the full investigations outlined in the programme, but if the work is first started, it is possible the assistant could be made to confine himself to some particular and more fruitful aspects of the programme. No work has yet been done on this important food-grain of the country and it is possible that even the preliminary work carried out by the assistant proposed, will be used by the Professor of Bio-Chemistry

as a stepping off ground for more elaborate and detailed investigations on the food value of the different cereal grains which he is contemplating to undertake at a future date.

It is on account of the importance of the investigation and its bearing on the breeding of the crop which so far has been mainly confined to increased outturns that I ventured to suggest the undertaking of it though a good portion of it is beyond my scope and experience.

ANNEXURE II.

EXTRACT FROM LETTER FROM THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, INDIA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 9C.2/7075, DATED THE 31ST JULY 1931.

SUBJECT :—*Application for money-grants to continue researches already begun at the Indian Institute of Science, Bangalore.*

I have the honour to inform you that my Council, at its meeting on Monday, 20th July, 1931, authorised me to apply, on its behalf, for grants in aid of the following subjects of investigation :—

* * * * *

(4) Extension of work on ' quality ' in crops. Cost over a period of two years : Rs. 5,400.

2. In support of this application I submit herewith detailed statements (enclosure to Appendix) by Dr. V. Subrahmanyam who, for the past two years, has been in charge of the biochemistry department at this Institute.

3. From these statements it will be observed that.....the principal items of the proposed expenditure from the grants now sought will be the salaries of the biochemists entrusted with the investigations. Suitably qualified biochemists will be available from among the postgraduate students of the Institute, many of whom have been actually engaged on the preliminary experiments.

4. The biochemistry laboratories at the Indian Institute of Science are fully equipped for the types of chemical and biological work involved, and there is an ample area of land available on the spot. Thus the inquiries will not entail much expenditure on apparatus and materials, and will not occasion loss of time to Dr. Subrahmanyam in supervising the field experiments.

5. It is not proposed to remunerate Dr. Subrahmanyam although he is highly qualified for the work, both by his experiments on these subjects at the Institute, and from his having spent two years at the Agricultural Experimental Station, Rothamsted, where he gained the Gold Medal of the Royal Agricultural Society.

Enclosure.

LETTER FROM PROFESSOR V. SUBRAHMANYAM, DEPARTMENT OF BIOCHEMISTRY, TO THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, No. 225/30, DATED THE 19TH JULY 1931.

I request that you will kindly move the Council of the Institute to approach the Imperial Council of Agricultural Research for a grant to enable us to extend our investigation on ' quality ' in crops.

Until recent years, quality in crops was considered to be a vague entity determined to a greater extent by individual taste rather than by any particular difference in chemical composition. With the recent discoveries in the field of nutrition, and in technical operations like malting, brewing and bread-making, it has come to be realized that the apparently negligible differences in composition caused by soil conditions, manuring, variety of seed, etc., to agricultural crops are highly important in assessing either the nutritive values of food materials prepared out of them or their suitability for various technical operations.

The following are some instances to show the importance of quality as distinct from quantity as represented by total yields of crops :—(1) The nitrogen content of the grain is an essential factor in the assessment of the milling quality of wheat and the malting quality of barley. In the former, a high content of nitrogen is essential to attain the desired strength while, in the latter, a low content of nitrogen is associated with high malting quality. (2) Heavy manuring increases the yield of tubers like potato and mangold wurzel, but the crops thus obtained contain more of water and partially assimilated salts than those raised on unmanured soil and in consequence possess less of (a) keeping quality and (b) feeding value than the latter, and (3) Grain and market garden crops raised on certain artificial fertilizers possess about the same chemical composition as those raised on organic manures, but are poorer in vitamins and essential amino acids than the latter.

Although the yield of crop is of primary interest to the farmer, yet the quality of the product is of fundamental importance to the consumer. This would apply particularly to a country like India where defective nutrition is so commonly prevalent. The importance of an investigation on quality, in its various aspects, can, therefore, be hardly over-estimated.

Recent investigations carried out in this department have shown that the malting quality of barley can be considerably improved by electrical treatment. Further work along that and allied lines have already been undertaken and promise to be fruitful.

With a view to obtain an idea of the nature of quality in rice, the staple food of hundreds of millions in India and the East in general, a systematic investigation was undertaken, in this department, in the beginning of 1928, in collaboration with the Paddy Specialist to the Government of Madras. Among the various aspects of the problem proposed to be studied, the following were some of the more important ones.

1. *The influence of season, soil conditions and manuring on the chemical composition and nutritive value of rice.*—Over 100 specimens of paddy, including all the well known varieties, grown in different parts of India were examined for their physical attributes, certain chemical constituents and calorific values. Further chemical examination and data from field observations are needed to finish the investigation. It is expected that the completed study will supply some valuable information relating to the above-mentioned aspects of the problem.

2. *The effect of breeding for increased yield on the nutritive value and sustaining power of the grain.*—This aspect of the study was, at the outset, intended to be with special reference to certain peculiar observations made by the Paddy Specialist to the Government of Madras with regard to certain new strains of paddy that were recently introduced in Godavari delta. The new (Aduturai) strains readily adapted themselves.

APPENDIX XXVIII.

NOTE, DATED THE 11TH AUGUST, 1934, ON SUBJECT No. 29, PROGRESS REPORT FOR 1933-34 ON THE SCHEME OF RICE PHYSIOLOGY BY PROF. R. H. DASTUR, ROYAL INSTITUTE OF SCIENCE, BOMBAY.

The second progress report (not printed) for the year 1933-34, on the above scheme of research is submitted for the consideration of the Advisory Board. The first report was considered by the Board in August 1933, *vide* printed proceedings of the Board, pages 40-41, 382 and 402-408.

2. The Vice-Chairman to the Council considers that it would be an advantage to have the report examined in the first instance by the Sub-Committee on rice research scheme consisting of :—

- (1) The Vice-Chairman, Imperial Council of Agricultural Research (Chairman *ex-officio*).
- (2) The Agricultural Expert, Imperial Council of Agricultural Research.
- (3) The Director of Agriculture, Madras (or representative of the Agricultural Department).
- (4) The Director of Agriculture, Bombay (or representative of the Agricultural Department).
- (5) The Director of Agriculture, Bengal (or representative of the Agricultural Department).
- (6) The Director of Agriculture, United Provinces (or representative of the Agricultural Department).
- (7) The Director of Agriculture, Burma (or representative of the Agricultural Department).
- (8) The Director of Agriculture, Bihar and Orissa (or representative of the Agricultural Department).
- (9) The Director of Agriculture, Central Provinces (or representative of the Agricultural Department).
- (10) Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa.
- (11) Rao Bahadur B. Viswanath.
- (12) Professor P. K. Parija, Ravenshaw College, Cuttack.
- (13) Dr. J. C. Ghosh.
- (14) Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.

Secretary, Imperial Council of Agricultural Research, Secretary *ex-officio*.

This Sub-Committee will meet on an afternoon between the 3rd and 8th September 1934 and its report will be circulated to the Advisory Board in due Course.

APPENDIX XXIX.

NOTE, DATED THE 1ST SEPTEMBER 1934, ON SUBJECT No. 30, APPLICATION FROM THE GOVERNMENT OF BENGAL FOR A GRANT OF Rs. 21,600 SPREAD OVER FIVE YEARS, FOR A SCHEME OF RESEARCH ON THE BIO-CHEMICAL AND PHYSICO-CHEMICAL PROPERTIES OF RICE AT THE BIO-CHEMICAL LABORATORY OF THE DACCA UNIVERSITY.

At its meeting held in February 1934, the Advisory Board considered the above application (Annexure I) and adopted the report of the Sub-Committee appointed to examine rice research schemes, *vide* relevant extracts from the proceedings of the Board and the Report of the Sub-Committee attached (Annexure II).

2. As recommended by the Board an enquiry was made from the Provincial Agricultural Chemists, as to the work done or being done in the various provinces on the bio-chemical and physico-chemical properties of rice, and an abstract statement of the information collected is enclosed (Annexure III). The scheme together with this abstract and other connected papers, namely, the pending scheme from Madras and the already sanctioned scheme of work at the Indian Institute of Science, Bangalore, was referred to Major-General Sir Robert McCarrison for advice, a copy of his letter No. 441, dated the 23rd August 1934, containing his remarks, is enclosed (Annexure IV).

The pending scheme from Madras referred to already, has since been received through the local Government and is being placed before the Advisory Board as a separate item (No. 28) of the Agenda. A similar scheme of research work has since been received from the Government of Bihar and Orissa and this also is being placed before the Advisory Board as a separate item (No. 31 of the Agenda).

3. With regard to the remark made by Lt.-Col. J. H. Russel, Public Health Commissioner with the Government of India, at the meeting of the Rice Sub-Committee held in February 1934 (*vide* paragraph 2 of the Committee's report (Annexure II) relating to co-operation with the School of Tropical Medicine at Calcutta, a copy of his letter No. 11/921-R., dated the 5th March 1934, containing the result of his discussion with Dr. Ghosh and the Director of the School of Tropical Medicine, is attached for information (Annexure V).

5. As desired by the Advisory Board at its last meeting, the subject will be examined, in the first instance by the Sub-Committee appointed to consider Schemes of rice research, namely :—

The Vice-Chairman, Imperial Council of Agricultural Research,
Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, Burma, Bihar and Orissa and Central Provinces
(or representatives of Agricultural Departments).

Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa.

Dr. J. C. Ghosh.

Rao Bahadur B. Viswanath.

Professor P. Parija, Ravenshaw College, Cuttack.

Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.

Secretary, Imperial Council of Agricultural Research, Secretary *ex-officio*.

This Sub-Committee will meet at 2-45 P.M. on Monday, the 3rd September 1934 and its report will be submitted to the Advisory Board in due course.

ANNEXURE I

SCHEME FOR RICE RESEARCH DRAWN UP BY THE BIOCHEMICAL SECTION, CHEMICAL LABORATORY, UNIVERSITY OF DACCA.

Biochemical and Physico-chemical investigations of the various samples of rice grown in Japan are considered to be very useful subjects of study and many publications on this subject by Japanese investigators have appeared in the last decade. These relate mostly to the proteins of rice seeds, (1), on the effect of the degree of polishing of rice on its absorption, (2), on rice-oxidase, (3) and similar subjects, (4). It must be observed however that at present much better methods are available for investigating the same problems.

European and American investigators have dealt with rice proteins and rice-starch mostly in connection with their investigations on proteins and starch from other cereals, (5). Many investigations have of course been carried out on the Vitamin B content of rice polishing.

Sen (6) has carried out a preliminary chemical study of the rices of Bihar and Orissa. Sen's paper also gives references to earlier work on the subject. Recently the Agricultural Chemist to the Government of Bengal has done some preliminary chemical analysis of a few types of Dacca rices (7). Both these investigators, it should be pointed out, have concerned themselves with the determination of moisture, ether extract, ash, total nitrogen, woody fibre and of some of the inorganic constituents like lime, phosphoric acid, and potash.

No systematic investigation on the physico-chemical properties, on the chemical composition, on the ensymic digestibility, on the nutritive value and on the vitamin content of the different varieties of Indian rice appears to have been undertaken. Investigations of the different properties of the same variety of rice grown under different manurial treatment have not also been done. It is therefore proposed to carry out a systematic and comprehensive investigation of the different varieties of rice grown in different parts of India from the abovementioned standpoints. All the investigations will be carried out with pure line strains in collaboration with the Department of Agriculture. Experiments would be made with parboiled and sun-dried rice and with polished and unpolished varieties.

Physico-Chemical Properties.—Mr. G. V. Jacks, Deputy Director of the Rothamsted Experimental Station, in a letter to Professor Ghosh on this subject says, "I am afraid we have been unable to find anything very pertinent on this subject. We have searched our own files thoroughly

and we have also made enquiries from the Imperial Institute and people who might have worked on it, but with very little success".

One important property of different varieties of rice that should be examined is the water absorbing power and the time taken to absorb the maximum amount of water. This would enable us to choose those varieties of Indian rice which would be able to compete with American trade rices like Carolina and Blue rose which fetch higher prices in Great Britain and other parts of the Empire because of their capacity for absorbing a greater amount of water.

Another important physical property which might be examined is the fuel value of different varieties. This might be easily done with the help of the "Oxy-calorimeter" of Benedict and Fox which is being used in the Nutrition Laboratory of Carnegie Institution of Washington, Boston. This apparatus (8) enables us to determine the calorific value from the volume of oxygen required for combustion.

Bio-Chemical study.—It is proposed to study thoroughly the chemical composition of rice with special reference to its nutritional value. Not only the percentage of ether extract will be determined, but qualitative and quantitative determinations will be made of substances like sterols and phosphatides which are very important from the standpoint of nutrition. This study will be all the more facilitated because of the micro-chemical methods which are in vogue in this laboratory. Preliminary investigation of ether extract of rice in this laboratory shows the presence of sterols. For the determination of rice protein it is customary to estimate the total nitrogen and multiply it by 6.25. It must be remembered that all proteins are not equally efficient for nutritive purposes. Thus Mitchell (9) by means of some feeding experiments on rats showed that the biological values of proteins from different sources were quite different.

The following table summarises his results :—

Protein from	Biological value.				
Milk	93
Corn	72
Oats	79
Rice	86
Potato	68
Yeast	85
Casein	71

Chemical analysis can give us some idea about the nutritive values of different rice proteins when the amounts of the essential amino-acids like cystine, lysine, tryptophane, tyrosine and probably histidine, proline and arginine which the animals cannot synthesise and must, therefore, receive in the form of foodstuffs for their growth, in the proteins are determined. It is, therefore, proposed to isolate the proteins from rice by successive extractions with (a) water, (b) solutions of neutral salts like 10 per cent. sodium chloride solution, (c) dilute alkaline solutions, and with (d) 70-80 per cent. alcohol. The nitrogen content of the residual rice will also be determined. The proteins will then be hydrolysed

and an attempt made to estimate quantitatively the abovementioned essential amino-acids. This is really a very difficult task and methods have not yet been perfected. Fischer's Ester method, (10) and Dakin's method, (11) do not come into consideration as they require very large amounts (100—500 grms.) of protein to start with and moreover do not afford a quantitative separation and estimation of any particular amino-acid. Hoffmann's method (12) which requires only 0.5-1 grm. of protein characterises a protein by distributing the nitrogen content of its hydrolytic decomposition products into three groups, (a) ammonia nitrogen, (b) basic nitrogen, (c) non-basic nitrogen and Osborne, (13) adds a fourth fraction, (d) humin nitrogen. By following the suggestions of Gortner and Holm (14) a quantitative measure of tryptophane can be obtained by Hausmann's method. Van Slyke's method (15) which is being tried in this laboratory has the advantage of requiring a relatively small amount (3 grms. or less) of protein and permitting a quantitative determination of arginine, histidine and lysine. The cystine comes about 30 per cent. too low.

Cystine and lysine can also be biologically determined by means of feeding experiments with rats. This will be referred to in a later section.

Quantitative determinations of sulphur by Pregl's and also by Ter Meulen's micro-methods will also be undertaken.

It is also proposed to perform the routine determination of cellulose, ash and moisture.

As regards the inorganic constituents besides the determinations of lime, phosphoric acid, and potash, qualitative and quantitative investigations for the presence of rare metals like manganese and if one might be allowed to say, copper, which have been recently shown to play a very important part in the prevention of anaemia, will also be made. It might be mentioned that Boyd and De (16) have recently applied the method of quantitative spectroscopic analysis to the determination of traces of manganese in urine. Examination of rice grown under manurial treatment of traces of manganese and copper salts might be undertaken.

Nutritional experiments with animals.—These experiments will be carried out from three view-points, viz., (i) biological determination of the essential amino-acids cystine and lysine; (ii) determination of biological value of rice proteins; and (iii) estimation of vitamins.

(i) *Biological determination of cystine and lysine.*—This might be done as recommended by Sherman and Words (17) by comparing the gains in weight during a period of 6 weeks made by standard albino rats (initial age 28-29 days) on a basal diet of limited cystine content but adequate in all other respects with the gains made by strictly comparable animals on the same diet supplemented by known additions of pure cystine (or by known additions of rice protein whose cystine content is to be determined).

It would be interesting to estimate both chemically and biologically the amounts of the essential amino-acids of the same varieties of rice grown under different manurial conditions.

(ii) *Biological value of proteins.*—This determination is very important since the biological value of a protein determines its nutritive

value. It is proposed to follow the method of Chick and Roscoe (18) and of Fixen, (19) who have improved upon the method of Mitchell, (20). Adult male rats of 300—450 grms. weight in metabolism cages described by Hopkins and Aekroyd (21) with detachable wire floor introduced by Boas (22) and glass separators of Gross and Connell, (23) to effect quantitative separation of urine and faeces might be employed for the experiments. The basal nitrogen expenditure will be first determined by using nitrogen free diets. In succeeding experiments the same diets would be used with added rice protein in varying proportions (upto about 16 per cent. of the total dry diet). Care would be taken to provide for the adequate supply of Vitamins B_1 and B_2 in whose absence, as has been shown by Fixen, there is a considerable decline in appetite and the intake of calories becomes too low to allow reliable figures to be obtained for the calculation of biological values.

The relative nutritive values of rice proteins might also be determined as has been done by McCollum and co-workers, (24) and by Mitchell, (25) and by others, (26) by maintenance experiments on rats. The consumption of food is generally *ad libitum* but it is essential as Mitchell points out that record of good intakes should be kept.

It would be really interesting and useful to determine the nutritive values of protein from the same variety of rice grown under different manurial conditions, specially in view of the observation of McCarrison (27) on millet and wheat.

Vitamin content.—Some attention, (28) appears to have been bestowed on some varieties of rice with regard to their Vitamin B_1 . It must be said, however, that quantitative determinations in terms of international units proposed by the Health Section of the League of Nations have not been done. It is proposed to examine the different varieties for the content of all the vitamins although it might be presumed that the amounts of Vitamins A, C, D are not likely to be large. Polished and unpolished rice as well as rice polishings would be examined.

Vitamin A.—According to "Vitamin—a Survey of Present Knowledge" issued by the Medical Research Council in 1932, only whole grains of rice and wild rice contain some Vitamin A. It is now proposed to make a search for this vitamin in all varieties of Indian rice.

Determinations would be made with young rats immediately after weaning (about 40 grms.). The breeding stock would be so fed that the young rats are not endowed with excessive reserves of vitamin A as has been done by Gudjonsson (29). The test animals would be allowed to exhaust their reserves of Vitamin A as indicated by cessation of growth, by being fed on a basal diet providing adequate amounts of Vitamins B and D. After this, doses of the test substance, rice, would be administered.

The values obtained by the biological method would be compared with those obtained from Carr and Price (30), blue values obtained with the Lovibond's Tintometer of the blue colour with antimony trichloride. The intensity of absorption at 328 might also be profitably measured.

Vitamins B_1 and B_2 .—Rice, specially rice polishings, is a rich source of Vitamin B_1 . The Vitamin B_1 would be estimated by curative tests on young rats. This method of Smith (31) consists in the determination of the minimal dose of the test material required to effect a cure of

acute polyneuritis in young rats which have been reared after weaning on a basal diet free from the Vitamin B complex, supplemented by autoclaved brewer's yeast to provide Vitamin B and by cod-liver oil. Some growth tests with rats, (32) will also be made.

Incidentally it is proposed to test the colorimetric method proposed by Spruyt (32) for estimating the anti-beri-beri vitamin percentage of rice. Since pure preparations of Vitamin B₁ have been definitely shown to contain sulphur (32-B) it would be interesting to find out the variations of Vitamin B₁ content of rice when sulphur dressing or sulphur containing manures are applied to the rice fields.

Determinations of Vitamin B₂ will be made by means of growth tests in which comparison is made between the amounts of materials needed daily by young rats to promote growth at a given standard rate, when these are administered as additions to basal diets adequate in all respects and lacking in Vitamin B₂ (33).

Vitamin D.—Young rats in which rickets would be produced by feeding them for about 3 weeks on a diet devoid of Vitamin D and having a high calcium and low phosphorus content (McCollum's diet No. 3143), would serve as experimental animals. Material to be tested would then be fed and determinations made by the estimation of ash contents of the femoral bones (34). An attempt will also be made to use the X-ray photography method by collaboration with the Mitford Hospital, Dacca.

In all the above experiments albino rats would be used and coprography would be avoided by using special cages.

Vitamin C.—Young growing guinea pigs (about 350 grms. in weight) would be employed for the purpose. The method adopted by Holst and his collaborators at the Lister Institute (35) is proposed to be employed.

Effect of different manurial treatment on the Vitamin content of rice would also be determined.

Enzymic digestibility.—It is proposed to find out the enzymic digestibility of different varieties of rice, parboiled and sundried, polished and unpolished and both new and old. Action of Taka-diastase, saliva, valt-diastase and diastase preparation from pancrease and similar enzymic preparations will be tried. The method of Willstatter, Waldschmidt-Leitz and Hasse (36) will be adopted to follow the course of the reaction. It would also be interesting to find out if the pure starch from all the varieties of rice are digestible at the same rate. The enzymic digests of the different rices might be analysed to find out how they differ from one another and in what respects.

* * * * *

The scheme will not involve the Imperial Council of Agricultural Research in any capital or recurring expenditure due to cost of apparatus, chemicals and equipment. The investigation will be supervised by Dr. Kalipada Basu, D.Sc. (Dacca), Ph.D. (Munich), who has been appointed Biochemist in the University of Dacca. It is, however, necessary to appoint two Research Assistants on the scale of Rs. 160—10—200 for a

period of 5 years. The expenditure on the part of the Council will be as follows :—

Recurring expenditure :—

	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
Two Research Assistants on Rs. 160—10—200 each per mensem.	3,840	4,080	4,320	4,560	4,800

Total expenditure for 5 years = Rs. 21,600.

ANNEXURE II.

SUBJECT No. 31.

SUPPLEMENTARY NOTE.

PROCEEDINGS OF THE SECOND MEETING OF THE COMMITTEE ON RICE RESEARCH SCHEMES, 22ND FEBRUARY 1934.

SUBJECT 31.—*Application from the Government of Bengal for a grant of Rs. 21,600 spread over five years for a scheme of research on the bio-chemical and physico-chemical properties of rice at the Dacca University.*

Professor Ghosh in introducing the scheme, explained that the Dacca University had established a Bio-chemical Department with a Reader in Bio-chemistry who had undergone special training in the bio-chemistry of cereals ; this was largely the result of a suggestion from the Bengal Department of Agriculture that there was a need for research work of this character. The Biochemist was also engaged in teaching M.Sc. students and required two research assistants. He considered that the programme of work contained in the printed scheme was too extensive for the staff proposed and therefore he now suggested that all the work on the vitamins of rice should be undertaken at the School of Tropical Medicine, Calcutta ; he understood from a discussion with the Professor of Biochemistry that he would be willing to undertake this research. If this part were omitted, he thought that the Dacca University could undertake the rest of the scheme.

2. Mr. Allan considered that the programme of work was still too large for the staff which it was proposed to employ and that it would be much better to concentrate on one or two of the more important aspects. Rao Bahadur B. Viswanath suggested that the plan of work still required a modification and he did not think that Professor Ghosh had received full information about the work already carried out in India on the chemical composition of Indian rice. He referred to the work which had been done at Coimbatore Agricultural Research Institute in co-operation with Colonel (now General Sir Robert) McCarrison. This work was published in 1924. As regards the nutritive value of different rice, the South India experiments indicated that the Kistna Valley rice was superior to Bihar rice which in turn was better than Tanjore, Bengal coming next and Burma last. But it seemed rather doubtful whether the differences between

individual varieties would be important. Marked differences in nutritive value were more likely to exist between large growers. It was also fairly well established that the lower nutritive value of polished rice was due to the reduction in the content of minerals and proteins. He would suggest that work might be concentrated on three lines, *viz.*, the determination of the amino-acids in different rices, the study of the mineral content of rices and the effect of manurial treatment on nutritive value. Nutrition experiments with animals were difficult and expensive and he considered that it would be wise to get as far as possible by chemical methods first. It was also very desirable that co-operation with the sanctioned scheme at Bangalore and the scheme proposed for Madras should be arranged. He would suggest the omission of the nutrition experiments with living animals at present.

Lieutenant-Colonel Russell, Public Health Commissioner to the Government of India, said that he was rather surprised to hear that the Tropical School of Medicine was in a position to undertake a new major research without additional staff and funds but he would discuss the matter at Calcutta very shortly when he was visiting the Tropical School of Medicine. His personal view was that if that institution was to take over the portion of the programme of work suggested, it would need more research assistants, more animal attendants, more animal accommodation and an increased grant for working expenses. He had doubts whether Calcutta was really suitable for nutrition experiments of this character. General McCarrison's work had shown that an equable climate was most important because it was necessary to eliminate outside factors. Work of this type meant using hundreds of animals for each experiment as a statistical analysis of the results was essential. He would discuss the matter with the Principal and Professor of Biochemistry at the Tropical School very shortly.

3. In the course of further discussion, it was suggested that the objections to Calcutta as a centre for nutrition experiments with animals might also apply to Dacca. Lieutenant-Colonel Russell then suggested that the scheme should be referred to General McCarrison for advice and opinion generally and especially in regard to the suitability of Calcutta and Dacca for nutrition work. Other members of the Committee suggested that General McCarrison might be asked whether he could undertake any part of this research.

Dr. Burns said that the effect of differential manurial treatment on the nutritional value of rice was important and perhaps the only portion of the scheme which was strictly agricultural. It was agreed that General McCarrison's comments on this question should be invited and the possibility of doing work of this nature in Bengal and Dacca.

4. Lieutenant-Colonel Russell agreed with the emphasis which Rao Bahadur Viswanath placed on the determination of the amino acids.

5. Professor Ghosh pointed out that the Dacca Laboratory was specially well equipped for work on micro-chemical analysis. He agreed that the study of amino-acids was essential but would also point out the importance of studying the changes in digestibility which occurred after storage and also the changes which took place when rice was par-boiled.

The general feeling of the Committee was that the work to be done should be divided between Dacca, Coimbatore and Bangalore and that the matter should be further considered at the next meeting of the Advisory Board.

6. Lieutenant-Colonel Russell emphasised the extreme importance of restricting the work which it was now proposed to carry out to rices grown under known conditions. All members agreed to this.

Finally, it was agreed that this scheme together with the pending scheme from Madras and the sanctioned scheme for work at the Indian Institute of Science should be sent to General Sir Robert McCarrison with a note of the Committee's discussion, inviting his opinion and advice. It was also agreed that before writing to General McCarrison an enquiry should be made from provincial Agricultural Chemists as to what work had been carried out and was actually in progress at the present moment and a summary of this should be sent also. Lieut.-Colonel Russell kindly offered to assist in the preparation of the draft to General McCarrison.

EXTRACTS FROM THE PROCEEDINGS OF THE ADVISORY BOARD, FEBRUARY 1934.

7. *Application from the Government of Bengal for a grant of Rs. 21,600 spread over five years for a scheme of research on the bio-chemical and physico-chemical properties of rice at the Dacca University. (Subject No. 31 on the Agenda).*—Mr. Burt introduced the report of the Rice Research Schemes Committee so far as it related to this scheme, and referred to the Committee's recommendation that this scheme together with the pending scheme from Madras and the scheme already sanctioned for work at the Indian Institute of Science, Bangalore, should be sent to General Sir Robert McCarrison with a note of the Committee's recommendation inviting his opinion and advice. He also mentioned that the Committee had agreed that before writing to Sir Robert McCarrison an enquiry should be made from Provincial Agricultural Chemists as to the work which had been carried out and was actually in progress at the present moment and a summary of this should also be sent. Lt.-Col. A. J. H. Russell had kindly offered to assist in the preparation of the draft to Sir Robert McCarrison. He added that on receipt of General McCarrison's reply the whole question should again be examined by the Committee and submitted to the Board at its next meeting. The Committee's report was adopted.

ANNEXURE III.

ABSTRACT STATEMENT SHOWING THE WORK BEING DONE IN THE VARIOUS PROVINCES ON THE BIO-CHEMICAL AND PHYSICO-CHEMICAL PROPERTIES OF RICE, AS ASCERTAINED FROM THE PROVINCIAL AGRICULTURAL CHEMISTS.

The only provinces in which work on the subject appears to have been done recently or where it is contemplated at present, are Madras, Bombay, United Provinces and Bihar and Orissa. The position is summarised below so far as information is available.

Madras.—

(1) *Work done.*—A large number of samples of rice grown in the Madras Presidency were analysed for their ash, fat, protein, fibre, carbohydrate and mineral contents. Part of the work was published in the Year Book of the Department of Agriculture, Madras, and part is waiting to be written up for publication.

(2) In a collaborative investigation with Major General Sir R. McCarrison, large numbers of samples of rices, from different places in India were analysed and feeding tests carried out. In this scheme of work, Raw Rice, parboiled rice, rice with different degrees of polishing, rice polished and washed were analysed. The several samples that were submitted to analysis in my laboratories, were used for nutrition tests by Major General Sir Robert McCarrison at Coonoor for their vitamin values. The results of these investigations were published in the Indian Journal of Medical Research.

Works completed and in progress and awaiting publication.

(3) *Organic phosphorus content of fractions of rice.*—In this, *tour* and bran were submitted to detailed examination in regard to their organic phosphorous content.

(4) *The changes that paddy undergoes on storage.*—This investigation comprises the periodical analysis of paddy on storage for its capacity to absorb water, swelling, changes in protein and ash contents.

(5) *Experiments with reference to cooking.*—This investigation has for its object the ascertaining of the action of different salts on the gelatinization of starch on cooking.

(6) Biological experiments with rats of the effect of adding oil, protein and minerals to polished rice.

Bombay.—

The following work is reported by the Agricultural Chemist, to be in progress.

Chemical and Bio-chemical study of Rice done in the Bombay residency.—

1. Assimilation of plant-food by Rice plant. (Bulletin No. 154 of 1928.)

Papers not yet published.—

2. Chemical study of the changes which take place in rice seed during germination.

3. A study of the Enzymes in the germinating and resting seed of rice.

4. A study of the distintegration of rice during storage and degestibility of new and old rice.

5. A study of the changes which take place during the formation of rice grain.

6. Effect of manuring the rice plant with Sulphate of Ammonia and other manures on the growth of rice plant and on the proportion of proteins in the rice seed.

United Provinces.—

No research has been undertaken on the bio-chemical and physico-chemical properties of rice. In 1930 some work was done on the chemical analysis of nine different varieties of rice including the determination of nitrogen and albuminoids, oil, woody fibre, moisture, ash and sugars. The varieties were of diverse characteristics—early medium and late, coarse, fine fragrant and without fragrance. No further work has been done since 1930.

Bihar and Orissa.—

No work on the strictly bio-chemical side of the problem has been or is being done. Some experiments were however conducted on the 'rate and extent of nitrogen assimilation by rice plant' and on the 'changes in mineral constituents and nitrogen in rice due to manuring'. The following items have been included in this year's programme :—

1. Relation of soil composition to quality in rice.
2. Chemical and physico-chemical basis of quality in rice.
3. Nutritive value of different varieties and those under manurial treatments.
4. Effect of storage on nutritive value.

So far as nutritive value is concerned this year's study will be confined to detailed chemical analyses excluding vitamin assimilation—also it will not be possible to do experiments on animals till proper laboratory equipment could be secured.

(*Note.*—This Programme seems very ambitious for the very limited facilities available at Sabour. It forms part of a Scheme recently received which has not yet been placed before the Advisory Board.)

B. C. BURT.

COPY OF LETTER FROM AGRICULTURAL CHEMIST, BURMA, MANDALAY, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 3137/ I.A.-10|A.C., DATED THE 18TH|20TH AUGUST 1934.

SUBJECT :—*Scheme for rice research drawn up by the Bio-chemical Section of the University of Dacca.*

With reference to your letter No. F.-60|34|Agri., dated 11th August 1934, I have the honour to say that I am not aware of any work carried out in Burma on this subject. In my Bulletin No. 146 of the Agricultural Research Institute, Pusa, 1923, I published certain figures showing the chemical composition of parboiled rices, *vide* Table XIV, page 37 but no systematic study has been attempted apart from ordinary chemical analysis which really conveys little useful information. Biochemical and physico-chemical properties of rice do not appear to have been studied at all in Burma.

ANNEXURE IV.

COPY OF LETTER FROM MAJOR-GENERAL SIR ROBERT McCARRISON, K.T., C.I.E., K.H.P., I.M.S., DIRECTOR, NUTRITION RESEARCH, INDIAN RESEARCH FUND ASSOCIATION, COONOR, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 441, DATED THE 23RD AUGUST 1934.

Reference :—Your No. 60|34-Agri., dated 30th July 1934.

I have the honour to acknowledge the receipt of your letter above referred to and, in reply thereto, to advise your Council as follows :—

- (a) That the scheme put forward by the Biological Section of the Chemical Laboratory of the University of Dacca be not sanctioned.
- (b) That the Scheme put forward by the Government of Madras be sanctioned only in so far as it relates to the effects of cultivation—manuring, etc.,—on the nutritive value of rice.

In view of the first of these recommendations your further question, as to the suitability of Calcutta, in preference to Dacca, for the proposed work, does not arise.

My reasons for these recommendations will become apparent from the consideration which follow : considerations set out in response to the request of your Council for my advice in regard to the rice-question in general :

Rice is the staple article of diet of approximately one-third of the total population of India. Its proper cultivation, whereby its nutritive value can be maintained at an optimum level, is, therefore, a matter of much importance ; an importance which is, however, limited by the properties of the grain itself.

The nutritive value of rice, and the place that it holds in this regard relative to other cereal grains in common use in India, depends on its content of four important food-essentials : proteins, fats, mineral salts and vitamins. With respect to one or other or all of these essentials it is definitely inferior to wheat, cambu, cholam, barley, ragi or bajri and maize. This inferiority may be illustrated by a comparison of its chemical composition with that of wheat :—

	Whole rice.	Percentage composition of : Whole wheat.
Minerals	12.8	14.0
Proteins	7.3	14.0
Fats	0.6	1.3
Carbohydrates	78.3	66.3
Fibre	0.4	3.3
Ash (minerals)	0.6	1.4 = 100.0

It will be observed that while whole wheat contains approximately twice as much protein, fat and mineral salts as whole rice, the carbohy-

drate-content of the latter is the greater. The fuel-value of *whole rice* is, therefore, not inferior to that of wheat or of other cereal grains.

As to the vitamin-value of *whole rice*, it may be said that the only vitamin requiring serious consideration is vitamin B, since no cereal grain is an important source of other essential vitamins (A, C and D). (Vitamin E need not be considered). From the accompanying figures (not attached) it will be seen that the vitamin B—value of whole rice is approximately one-half that of whole wheat.

The defects above mentioned are those inherent in the whole rice-grain. It is well-known that in spite of great differences in appearance, as well as in the conditions under which different samples of rice are grown, the nitrogenous and other constituents of whole rice vary within relative narrow limits. Thus, in regard to proteins the minimum content is rarely less than 7 per cent. and rarely more than 8 per cent. Grains of the finest composition are those from plants grown either in rich virgin soil or on land which has been liberally manured : the latter is no doubt the cause of the excellent quality of Japanese rice.

It is apparent, therefore, that there is an optimum point of nutritive value beyond which the best whole rice cannot go and this point is well below that for whole wheat and certain other cereals in common use in India. No amount of research is likely to yield results which, if put into practice (a doubtful contingency), would increase the nutritive value of whole rice to any considerable extent. The obvious way to improve the nutritive value of the rice-eater's diet is to provide supplements to the rice which make good its defects. With such supplements rice is a very valuable food-material and one well suited to the climatic conditions of those parts of India wherein it is the staple article of diet of the people.

Hitherto I have dealt only with *whole rice*. But, as is well-known, rice in its whole state is not used as food. Before consumption it is subjected to certain refining processes which further reduce its nutritive value ; the amount of reduction depending on the nature of the process, or combination of processes, to which it is subjected. These processes are : Home-pounding ; milling in raw state with varying degrees of polishing ; parboiling and subsequent milling ; washing ; and cooking. The effects of these processes are fully dealt with in *Indian Medical Research Memoir No. 2*. (October, 1924), by McCarrison and Norish. All of them lower the nutritive value of the original grain to a greater or to a lesser degree ; this lowering being due to loss of proteins, fats, mineral salts and vitamins. The process of parboiling is peculiar in that it causes the outer layers of the grain to adhere to the endosperm and so preserves to a considerable extent, the vitamin B content of the grain. But this preservation is, in practice, generally short-lived ; for the washing to which parboiled rice is, as a rule subject before consumption has the effect of removing, in great part, the water-soluble vitamins. Further, the small amount of vitamin A contained in the original grain is destroyed by the parboiling process. The net result of all this is that rice, as consumed, is a poor staple food upon which to build a physiologically efficient diet ; much poorer than other cereal grains (wheat, cambu, ragi, etc.), which are in this country, customarily consumed in the whole, or practically whole, condition. The rice-eater's diet, especially in persons of the poorer classes, is likely, therefore,

to have four grave faults : deficiency of suitable protein ; deficiency of mineral salts ; deficiency of fats ; and, deficiency of vitamins.

No cereal grain, however, good it may be, is in itself a complete food. It needs to be supplemented with other food-materials which make good its defects. So far as rice is concerned these defects—especially when polished rice is used—are relatively greater than are those of other grains ; and they demand that the supplements to the rice-eater's diet must be adequate and well chosen. The problem, therefore, is not so much one of improvement in the nutritive value of the rice itself as of provision of supplements to the rice which will make the rice-eater's diet physiologically complete.

In view of these considerations it may well be asked : " What is expected to be achieved by further research on the nutritive value of rice ? " Is it intended thereby to devise means for increasing the protein, the mineral or the vitamin content of the rice ? For if this be the intention it can only be successful to a limited extent, and that success will depend on the extent to which rice-growers can be induced to improve their methods of cultivation. Or is it the intention to acquire knowledge for the sake of knowledge ? If so, it is a laudable one ; but, unfortunately, it is one that holds out little prospect of utility to the rice-eater. Interesting as it is to the scientist to know that the proteins of rice are of this or that order of biological value,* it is of no interest to the poorer class rice-eater whose diet does not contain a sufficiency of any kind of protein. What he wants is more protein, and that he cannot get from rice however good the rice may be. Were money no object to your Council, it would no doubt be of interest to carry to a successful issue a scheme such as that propounded by the University of Dacca. But as money is a matter of prime importance I cannot recommend that it be spent in the way suggested. Even were it decided to proceed with this Scheme it would be necessary to take exception to it on the grounds, already referred to by one member of your Council, that it is far too extensive to be undertaken except in a properly equipped Institute for Nutrition, staffed by scientists of skill and experience.

Investigations dealing with the cultivation, manuring, etc., of rice, and with the effect of such cultivation on the nutritive value of rice, are of a different order : these should receive the Council's support ; not only on account of their value in regard to rice but to vegetable foods in general.

Personally, I am of opinion, that the Imperial Council of Agricultural Research should concentrate its attention not so much on a study of the nutritive value of rice as on research dealing with the greater production in this country of cheap supplements to the rice-eater's diet. The addition to such a diet of a handful of whole wheat, or of Soya-bean, or of ground-nut cake to which a small proportion of casein is added and the freer use of milk and milk-products will do more to raise the nutritive value of a rice-diet, and to improve the physique of its users, than all the research on the nutritive value of rice itself that it is possible for the mind of man to devise.

I cannot conclude this letter without some reference to a matter with which, I feel, your Council should concern itself, viz : A Survey of the

*Vide : Attached extract from Tropical Diseases Bulletin.

Food Resources of India. In this connexion I append a Memorandum recently submitted by me to the Public Health Commissioner with the Government of India. This survey is, in my opinion, so urgently needed as to take precedence over any other investigation dealing with food or food-production. It is, indeed, an essential preliminary to such investigations.

I would direct attention, also, to the following publications wherein is to be found much information in regard to the general question of rice :—

- (i) *The Agricultural Ledger*.—No. 5 for 1908-09 (Vegetable products Series, No. 110), prepared by Mr. David Hooper, F.C.S., and published by the Indian Government of Calcutta.
- (ii) *Food Grains of India* by Professor A. H. Church.
- (iii) *Madras Agricultural Department's Year Book* for 1920-21.

TROPICAL DISEASES BULLETIN.

Vol. 31, No. 7, July, 1934. pages 478-479.

"Phillippine Rice-Mill Products with Particular Reference to the Nutritive Value and Preservation of Rice-Bran."

(Phillippine Jl. Sc. 1933, September, Vol. 52, No. 1, pages 1—78.)

By

West, A. P. and Cruz, A. O.

The average yearly production of paddy (unhulled) rice in the Philippines is two million metric tons. In the Phillippine process of milling the rice is passed through a huller, the hulls are used in the boiler, and the rice is polished, in which process the bran, consisting of the entire seed coat and the embryo as well as most of the aleurone layer is removed. Polished rice usually contains remnants of the oily aleurone layer, and the oil tends to become rancid when the rice is stored for some time. Rice starch is used in laundering, preparing foods, making pastes, medicinal tablets and cosmetics. Rice hulls are used for fuel, packing hygroscopic materials, filtering, and the ash makes good polishing powders. Polished rice keeps much better than, and does not become infested with insects as does unpolished rice. The fats, proteins and vitamins of the paddy rice are contained chiefly in the bran. High-grade moisture-free bran should contain at least 20 per cent. of vegetable oil. For human consumption the bran should contain practically no hulls as they irritate the intestine, and in milling a very efficient blower should be used. The presence of hulls in the bran can be determined microscopically.

The proteins of rice bran are similar to those of meat and milk and soya-bean ; their biological value compares favourably with those of meat. The bran contains an excess of phosphorus as compared with lime and in this respect is unbalanced. In other respects it is an excellent food, being more nutritious than hydraulic copra cake, wheat bran, Graham and straight grade flour. If its natural flavour is objected to, this may be toned down by mixing with wheat flour ; 3 parts of wheat flour and 1 of bran make a good mixture for bread and cakes. The bran does not contain gluten and the wheat flour remedies this deficiency. Beriberi is a very

common disease among the poor of the Philippines and for this reason the Vitamin B content of the bran assumes special importance. The yield of the tikitiki extract from bran varies considerably, the potency of 1cc. of the standard extract is that of 14.5 gm. of the high-grade rice bran. It has been estimated that for people who are susceptible to beriberi 30 gm. of rice bran daily provides sufficient vitamin B. The annual production of rice bran in the Philippines is about sufficient for all the people requiring it for its medicinal value and for others who might possibly benefit from its use.

Deterioration of rice-bran is caused by insect infestation and also by hydrolysis of the rice oil in the presence of moisture, due to the lipases present in the vegetable tissue. This decomposition causes a disagreeable taste. The authors' results indicate that the best method for preserving the bran is to heat it at a temperature of about 105°C. for 3 hours and then keep it in moisture-proof packages, for which cellophane is the best material. The vitamin content is not affected by this process, and the lipases only appear to be rendered inactive for moisture gains access and hydrolysis commences. Heating at 120°C. for 6 hours appears to destroy the enzymes. In preparing rice bran for storage a cooker containing a stirrer should be used as stirring assists the removal of moisture; the bran should be packed whilst hot. Where proper facilities are not available, the bran may be heated, with continual stirring, in frying pan over a low fire until the bran turns slightly darker in colour; it is then placed in a can or glass jar which must be closed tightly. The bran will then keep in good condition for a week or more. The heated bran has more pleasant flavour than the fresh raw bran. In the Philippines fine rice bran is very cheap and is used chiefly for feeding cattle and poultry. For the poorer classes, whose diet is principally polished rice, the use of rice bran would remedy to a considerable extent the present deficiencies in fats, proteins and vitamins. It would prevent beriberi and improve the general health, and at the same time develop the natural resources of the country (H. N. H. Green).

SUBJECT :—*Survey of Food-material and their food-values throughout India. (P. H. C. letter No. 262/2011, dated the 13th April 1934.)*

In a previous communication (my letter No. 1094 of 28th March, 1934), I had the honour to direct your attention to the need that exists for a survey of food resources of India, and for a determination of the food-values of the various articles entering into the dietaries of the Indian People. In that communication I suggested that this object might be attained "by enlisting the assistance of the Agricultural Departments of all Presidencies and Provinces".

Of the necessity to undertake this project there is, I hope, no need to speak at length. It is a necessity recognized long since by other countries; such, for instance, as Japan and the Philippines: with the result that at the present time every article of food used by their people has been catalogued and its food-value determined by accurate chemical analysis and other means of assay. Two purposes are served by so doing: tables of food-values are thus made for the information of the public; and a

number of food-materials, not perhaps in general use, are revealed as possessing nutritive values of a high or particular order. There is, for instance, in certain parts of India, a marked deficiency in the calcium, the phosphorus, the iron or, it may be, the iodine-content of the food of the people. It is well therefore, to be aware of the several food-materials that may be made use of in order to avoid these disease-producing deficiencies. There is, too, a widely spread lack of certain vitamins in the food ; it is essential that the people of every province should have available to them sufficiently accurate information as to the sources from which these vitamins may most readily be obtained.

The question, rather, is how to proceed in a matter of such seeming magnitude. As I pointed out in my previous communication the variety of food-stuffs used by the people of India is widely different in different parts of the Peninsula. Even when the food-stuff is the same its chemical composition and, therefore, its food-value may differ according to the region in which it is grown. Because some vegetable food-stuff is botanically the same in different parts of India it does not follow that it is chemically and nutritionally the same. It is not fitting, therefore, that such a survey as is here suggested should be undertaken by a single chemical laboratory located somewhere in India. Expediency, efficiency and celerity require that it should be undertaken by the various chemical laboratories distributed in the various Presidencies and Provinces. The laboratories of the several Agricultural Departments are those in which the necessary chemical analysis could best be carried out. The Departments are in close touch with the agricultural activities of the Provinces in which they are located ; their chemical laboratories are day by day engaged in such analyses of food-materials as is here suggested ; probably some of them have already accumulated a considerable mass of chemical data in regard to the foods produced in their respective Provinces. It needs but a little co-ordination, the routine analysis, with a definite end in view, of every known food-material in every Province, and the adoption of a uniform system of recording the results of analyses, to provide within relatively short time all the information that India so sorely needs in regard to the foods used by her people.

I venture to think that if the various Provincial Governments were approached by the Government of India with the object of enlisting their co-operation in this matter it would be readily given.

My detailed proposal is this :—

- (1) The Agricultural Department of each Presidency or Province should be asked to make a preliminary survey, of all food-materials, however, rare their use may be, entering into the dietaries of the people of the Presidency or Province. These food-materials to be catalogued under the following headings :—

- I. *Vegetables and vegetable products* : including flowers, fruits, vegetables, leaves, legumes, roots, tubers, shoots.
- II. *Grains and products of grains* : including barley, maize, millet, wheat, rice and other food-grains ; and their products ; flour se moline, etc.
- III. *Milk and its Products* : of the cow, buffalo, goat, camel and sheep. Butter, ghee, curds, cheese, cream.

- IV. *Meat and meat products* : including flesh meat (of cattle, sheep and goats) ; organs (heart, brain, kidney, liver), tongue, marrow sweetbread, suet.
- V. *Poultry and game* : including eggs.
- VI. *Fish* : fresh, salted, dried : and miscellaneous animal foods of this order (molluscs, shell-fish, etc.).
- VII. *Sugars* : including jaggery, refined sugar, syrup and honey.
- VIII. *Beverages* : including fresh fruit juices and fermented beverages.
- IX. *Tea, Coffee*.
- X. *Condiments, spices, pickles*.
- XI. *Miscellaneous materials*, not coming within previous categories ; such, for instance, as sweetmeats and other Indian cooked foods or dainties on sale in bazaars or at railway stations.

(2) A table of analyses of these materials should then be prepared from existing data and from new data derived from chemical analyses in the future. This table to include : the moisture, ash, protein, fat, crude fibre, carbohydrate, calcium, phosphorus, iron (and in Himalayan and sub-Himalayan regions, iodine) and vitamin-content of the edible portion of each food-stuff. It should include also a column showing the calorie-value of each article of food.

A specimen form,* suggested for general use, is appended.

(3) The accurate determination of the vitamin-content of these food-materials is a tedious, difficult and expensive process, and it may be questioned whether, in the present state of knowledge and for our present purpose, it is worth while. Personally, I do not think it is. For the modern Science of Nutrition cannot, as yet, give a definite numerical value of the vitamin-content of any food-material, nor is it known with precision how much, by weight, of this or that vitamin is required daily by human beings of different ages. What we do know is that these vitamins are highly important constituents of food ; and, they are needful, for proper nutrition, in those amounts that are present, in natural, unsophisticated food-stuffs, in combination with other elements and complexes necessary for such proper nutrition. For our present purpose all that is required is to indicate in the Table of Food-values the best sources of these vitamins. And here advantage may be taken of existing knowledge without resort to the actual assay of the vitamins in each food-material, unless, indeed, facilities—biological, spectrographic or chemical—for such assay exist in the laboratories concerned.

*In this form it has been necessary to use both the metric and the British system of weights. For, while the consumer purchases the ingredients of his food in ounces or pounds the dietitian thinks or calculates in grammes or milligrammes : hence the dual system adopted in the Table.

Appended are certain broad, general rules which will enable a sufficiently accurate indication to be given of the vitamin-contents of the various food-stuffs.

It is possible, even probable, that the immediate undertaking of this project by the several Agricultural Departments throughout India would necessitate an increase in their existing chemical staff. India has large numbers of young chemists well fitted under proper supervision for this work. I have no doubt that an advertisement offering a salary of Rs. 150 per mensem would bring in some hundred replies. Here, then, is not only an opportunity to accomplish a much-to-be-desired end but an opportunity to provide temporary employment for many unemployed, young Indian Chemists ; the latter is a much-to-be-desired end in itself.

Assuming, then, that the necessary analytical work required the employment, by each Department of Agriculture in India, of 12 additional chemists each at a salary of Rs. 150 p. m., and one supervising chemist at Rs. 300 p. m., the cost per annum for staff would be as follows :—

	Rs.
	Per annum.
12 Chemists at Rs. 150 p. m. ..	21,600
1 Supervising Chemist at Rs. 300 p. m. ..	3,600
	<hr/>
Total ..	25,200
	<hr/>

If to this were added say Rs. 10,000 per annum for extra apparatus and chemicals the total of the enterprise, for each Presidency or Province, would not exceed Rs. 35,000 (or say, Rs. 40,000) per annum, a cost trifling in comparison to the value of the results that would be achieved.

With this staff it should be possible for each chemist to furnish a complete analysis of one food-stuff every two days. There are 288 working days in the Government year, and allowing half-a-day for each of the 46 Saturdays we arrive at 265 days. If each chemist were to produce a complete analysis of one food-stuff every two days he ought to deal with at least 130 food-stuffs in the year. Twelve chemists could, or should, therefore, provide analyses of over 1,500 food-stuffs in a single year. On this basis the whole enterprise if properly organized, should be completed throughout India in a year or at most two years time.

In order to organize and co-ordinate effort throughout India and complete this project in the shortest possible time I suggest that an experienced officer be placed in charge of it by the Government of India ; this officer's duty to include quarterly visits to each laboratory throughout India where the work is in progress, and the submission of a final report to Government on its completion. This Report should then be gone into by the Director of Nutrition and Tables of Food-values for the whole of India issued thereafter by the Central Government.

In the preparation of this Note I have been handicapped by want of intimate acquaintance with the administration of a Department of Agriculture ; and, also, by want of knowledge of the laboratory and other facilities for the suggested work which are available in each province. But

on occasions during past years I have had to seek the co-operation and assistance of Officers of various departments of Agriculture ; and judging by their readiness to co-operate and to assist in any measure designed to benefit the people of this country I am confident that the Agricultural Departments themselves would view this enterprise with the fullest sympathy, would unhesitatingly co-operate in it, and, out of the abundance of their knowledge and experience, would add greatly to the value of the results to be achieved by it.

General Rules for indicating Vitamin-values of food-stuffs.

The following general rules should enable the columns in the Table of food-values headed ' Vitamin A ', ' Vitamin B ' and ' Vitamin C ' to be filled in opposite each food-stuff with sufficient accuracy :

- (a) All *whole* grains, seeds and fruits, which are capable of growth when planted in suitable soil, are rich sources of Vitamin B. (It is unnecessary to complicate the Table of Food-values by the division of this vitamin-complex into its component parts). Their richness in this vitamin may be indicated in the Table of Food-values by three plus signs : + + + Such grains also contain some Vitamin A, which may be represented by the sign < + , but no Vitamin C ; the lack of the latter should be indicated in the Table of Food-values by the negative sign (—) or by zero (0).
- (b) All products of food-grains or legumes contain less Vitamin B than the original article, unless the product be the whole article in another form. Thus, if we represent the Vitamin B-value of whole wheat by three plus signs (+ + +) it will be safe to represent that of whole wheat flour by two (+ +), that of white flour by one (+) and that of sophisticated flour by less than one (< + or ±).
- (c) All fresh, green vegetable foods are rich sources of Vitamin C. Broadly speaking their richness in this factor is proportional to their greenness and freshness ; and, it may be represented by three (+ + +), two (+ +) or one (+) plus signs according thereto.
- (d) The *growing parts* of all plants used as food as (e.g., the growing tips) contain Vitamin A ; the amount of it may be represented by a single plus sign (+). They also contain Vitamin B in amounts represented by one plus (+), and of course, Vitamin C (+ + +).
- (e) All yellow golden or reddish coloured vegetable foods, whether grown above or below ground, contain Vitamin A ; the amount of it may be represented by two (+ +) or by one (+) plus sign according to the degree of colouration.
- (f) All edible parts of herbs bearing seed—apart from the seed itself which is rich in it contain some Vitamin B ; the amount of which may be represented by a single plus sign (+).

- (g) All fresh tubers and roots contain vitamins B and C. The former may be represented by a single plus sign (+); the latter by two plus sign (+ +). They also contain some Vitamin A (< + or ±); and if yellow coloured they may contain it in considerable amounts [*vide* (e) above].
- (h) All fresh fruits and their fresh juices are rich sources of Vitamin C (- + +). All yellow, golden or reddish fruits contain Vitamin A (+).
- (i) All sprouted grains contain Vitamin C (+) although the unsprouted grains contain none (+).
- (j) All animal fats are rich sources of Vitamin A ; less so in India—where the fodder of cattle, sheep and goats is so often scanty and parched—than in western countries. All vegetable fats contain little or no Vitamin A. The former class of fats should have two plus signs (+ +) assigned to them under this heading, the latter a negative sign (—). Certain vegetable oils contain *some* (< +) Vitamin A ; but in general, these oils are a very poor source of this important factor. It is best, therefore, to indicate this paucity by the negative sign in all cases.
- (k) All fresh foods contain Vitamin B ; a single plus sign (+) is a sufficiently accurate indication of its amount.
- (l) All organs (liver, kidney, sweetbread, etc.), are rich sources of Vitamin B : two plus sign (+ +) will indicate this with sufficient accuracy.
- (m) Eggs contain both Vitamin A (+ +) and B (+ +) but little or no Vitamin C (—).
- (n) All fish oils contain Vitamin A : fresh water fish (+) and sea-fish (+ +).

+++ indicates ' rich in ' :

++ indicates ' moderately rich in ' ;

+ indicates ' some ' ;

< + indicates ' traces of ' ; and

< — indicates ' none ' .

Specimen Table.

Table of Food-values.

Sample.	Waste or refuse.	Moisture %.	Ash.	Edible portion.							Fuel value Calories.	Vitamins.			Remarks.
				Protein.	Fat.	Carbohydrate.	Calcium.	Phosphorus.	Iron.	Iodine.		Vitamin A.	Vitamin B.	Vitamin C.	
(English names to be given in all cases, together with vernacular names). <i>Example.</i> Maize on cob ..	57.28	68.43	0.57	3.20	0.52	15.66	0.013	0.188	1.92	7	82	+	++	—	Very pale yellow.

NOTES :—

- (a) Waste or refuse to be shown as percentage of total sample.
 (b) Moisture to be shown as percentage of the edible portion.
 (c) Ash, protein, fat, carbohydrate to be shown as *grammes per ounce*.
 (d) Calcium, phosphorus and iron to be shown as *milligrammes per ounce*.
 (e) Iodine to be shown as ($\approx 1/1000$ of a milligramme) per kilogramme.
 (f) Fuel value to be calculated in calories per ounce as follows :
 Proteins in grammes $\times 4.1$ + carbohydrate in grammes $\times 4.1$ + fat in grammes $\times 9.3$ = calories.

ANNEXURE V.

COPY OF LETTER FROM THE SECRETARY, SCIENTIFIC ADVISORY BOARD, INDIAN RESEARCH FUND ASSOCIATION, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 11/921-R., DATED THE 3RD/5TH MARCH 1934.

I have the honour to say that in accordance with the promise which I made to the Vice-Chairman of the Imperial Council of Agricultural Research at the meeting of the Rice Research Sub-Committee which I attended on the 21st February, I discussed the case with Lt.-Col. Knowles, I.M.S., Director of the School of Tropical Medicine, Calcutta, and with Dr. Ghosh, Professor of Chemistry, during my recent visit to Calcutta. The 'Nutritional experiments with animals' (page 3 of the printed note) consist of three sections :

- (i) Biological determination of cystine and lysine,
- (ii) Biological value of proteins, and
- (iii) Estimation of Vitamins.

Dr. Ghosh is at present doing work on No. (iii) only and he told me that he is willing and prepared to carry out this work. At the same time he would be unable to do so unless he got a grant from the Imperial Council of Agricultural Research for extra staff which I gather would include : (a) a chemist, (b) an animal attendant, and (c) certain equipment.

I did not go into the question of a detailed budget, but discussed the general question with Lt.-Col. Knowles as to the possibility of this work being done in addition to the other research and teaching work which Dr. Ghosh has in hand, and I was given to understand by Lt.-Col. Knowles and by Dr. Ghosh that it would be possible for the latter to undertake the work. In these circumstances I presume there would be no objection raised by the Governing Body of the School of Tropical Medicine if Dr. Ghosh undertook this work.

L192ICAR

APPENDIX XXX.

NOTE, DATED THE 24TH AUGUST 1934, ON SUBJECT No. 31, APPLICATION FROM THE GOVERNMENT OF BIHAR AND ORISSA FOR A GRANT OF Rs. 8,490 SPREAD OVER THREE YEARS FOR A SCHEME FOR BIO-CHEMICAL RESEARCH ON PADDY.

Attention is invited to the attached letter No. 766-D.R., dated the 20th August 1934 from the Government of Bihar and Orissa (Annexure) forwarding a scheme of research on the bio-chemical problems of paddy. This scheme involves so far as the Council is concerned, a total expenditure of Rs. 8,490 spread over three years, including a non-recurring expenditure of Rs. 1,500.

2. The Vice-Chairman to the Council considers that the application from the Government of Bihar and Orissa should first be examined by the Rice Sub-Committee of the Council consisting of :—

The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, Burma, Bihar and Orissa, Central Provinces (or representatives of the Agricultural Departments).

Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa.

Dr. J. C. Ghosh.

R. B. B. Viswanath.

Prof. P. K. Parija, Ravenshaw College, Cuttack.

Mr. M. Vaidyanathan, Statistician, I.C.A.R.

Secretary, Imperial Council of Agricultural Research—Secretary, *ex-officio*.

2. The Sub-Committee will meet on an afternoon between the 3rd and 8th September 1934 and its report will be submitted to the Advisory Board in due course.

 ANNEXURE.

COPY OF LETTER FROM THE SECRETARY TO GOVERNMENT, EDUCATION AND DEVELOPMENT DEPARTMENT, BIHAR AND ORISSA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 766-D.R., DATED THE 20TH AUGUST 1934.

SUBJECT :—*Scheme of research on the biochemical problems of paddy.*

With reference to the correspondence resting with your letter No. F-234/34/Agri., dated the 31st July, 1934, I am directed by the Government of Bihar and Orissa (Ministry of Education) to say that as desired by the Imperial Council of Agricultural Research, the combined scheme has been separated into two schemes, *viz.*, (1) Research on the regeneration of sand affected lands, and (2) Research on the biochemical problems of paddy.

3. The scheme for research on the biochemical problems of paddy has been revised and the expenditure involved has been considerably reduced. The total cost of the revised scheme is Rs. 8,490, Rs. 6,990 recurring and Rs. 1,500 non-recurring, spread over a period of three years. The Agricultural Chemist has undertaken a considerable amount of work in this connection, but his existing staff which includes only one gazetted assistant is unable to cope with the increased work and some assistance from the Council is necessary. In the circumstances, I am to request that the Council may be pleased to sanction the scheme as revised and to allot the necessary funds.

4. (a) Aeration in paddy lands. The role of algal flora in supplying oxygen to the plant.

(b) Effect of "Nigar" on the cultivation of rice. After the utility of "Nigar" is established by Agricultural experiments, biochemical work on its effect on soil condition and microflora and the quality of rice will be undertaken.

5. Nitrogen fixation, humus formation, reaction under Bihar and Orissa condition and if possible fractional separation of organic matter and its identification.

6. Manurial Experiments. It is not considered enough simply to apply certain manures or their mixtures and see their effect on yield but it is intended to examine soil and crop at critical stages of crop growth and correlate the uptake of the manure by the crop with the knowledge of the root system (which already forms a part of the physiological work of the Rice Specialist and where considerable data has been collected) will give us an insight into the fundamentals of the manuring of rice. The manuring experiments will aim at getting information on the following main points :—

(a) Organic vs. inorganic fertiliser.

(b) Determination of optimum N : P₂ O₅ ratio in the fertiliser mixture for Bihar and Orissa conditions.

(c) Time of application of Manures (especially easily available Nitrogen) as a factor in determining yield and quality of crop.

A certain amount of work on most of these problems is already being done by the Rice Specialist and the Agricultural Chemist. It is necessary to supplement and intensify this work so as to make the work of Rice Research Scheme as complete as possible in all its aspects, botanical, physiological and chemical. This work will be directed by the Agricultural Chemist in close co-operation with the Rice Specialist. The department's chemical staff cannot cope with the detailed investigations necessary.

Financial.—

I. NON-RECURRING.—

(a) Laboratory equipment	Rs.
(Microchemical and other apparatus).	1,500

I. RECURRING.—

A. *Establishment*.—

(1) One Scientific Assistant (Biochemical) @ Rs...	100—5—110
(2) One Laboratory attendant @ Rs.	10
B. Laboratory Contingencies Rs.	750 per annum
C. Travelling Allowance	200 „

The table gives the details of recurring expenditure per year for 3 years.

Particulars.	First year.	Second year.	Third year.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
1. Establishment	1,320 0 0	1,380 0 0	1,440 0 0
2. Laboratory Contingencies	750 0 0	750 0 0	750 0 0
3. Travelling Allowance	200 0 0	200 0 0	200 0 0
Total	2,270 0 0	2,330 0 0	2,390 0 0
Total Recurring for 3 years	6,990 0 0		
Non-Recurring	1,500 0 0		
Grand Total	8,490 0 0		

A Scheme for Biochemical Research on Paddy.

The biochemical work on paddy is at present being done by the Agricultural Chemist, Bihar and Orissa. The Rice Research Scheme, financed by the Imperial Council of Agricultural Research, which has been functioning since 1932, has no chemical assistant in the staff. With the limited staff of the Agricultural Chemist, it has not been found possible to do justice to the bio-chemical aspect of the rice research. The need for this scheme can be judged from the important problems that await solution. They are outlined below :—

1. Determination of quality of rice—

- (a) Physical basis such as size, weight, shape of grain, etc.
- (b) Physico-chemical such as water absorption, etc.
- (c) Chemical composition—detailed analyses including differentiation of proteins. Disintegration as well as Fractional liquefaction of starches and if possible study of Vitamins and enzymes.
- (d) Flavour and taste—Methods to be evolved for this test.

Note.—It is not intended for the present to carry out actual nutritive tests on animals but only to obtain physico-chemical evidence for determining the quality in rice.

2. Quality as affected by—

- (a) Storage.
- (b) Different climatic, soil and manurial conditions.

3. Rate and extent of absorption of different ions (from added fertilizer) by soil under paddy land conditions (laboratory as well as field experiments will be necessary).

APPENDIX XXXI.

NOTE, DATED THE 7TH AUGUST 1934, ON SUBJECT No. 32, APPLICATION FROM THE GOVERNMENT OF THE CENTRAL PROVINCES, FOR A GRANT OF RS. 10,088 SPREAD OVER FOUR YEARS FOR RESEARCH WORK ON THE 'GANGAI' PEST OF RICE—ENTOMOLOGICAL WORK UNDER THE SCHEME OF RICE RESEARCH ALREADY SANCTIONED BY THE COUNCIL FOR THE CENTRAL PROVINCES.

Attention is invited to the attached note (Enclosure I), dated the 24th January 1934, circulated to the Advisory Board at its meeting held in February 1934. Relevant extract from the Report of the Committee which was adopted by the Board, is reproduced below :—

* * * * *

The Director of Agriculture, Central Provinces, explained to the Committee that this pest which bores the stem of the paddy plant and frequently destroys it, appears to have been serious for the first time in 1932. Professor Parija considered that it was probably identical with an insect which had occurred in the Angul district of Orissa. It was decided that an enquiry should be made as to whether other provinces have suffered from this pest. Meanwhile the Director of Agriculture, Central Provinces, will furnish some further information which is being collected regarding the amount of damage done by it in the Central Provinces.

* * * * *

2. The enquiries made show that the rice crops of the United Provinces, Punjab, Bihar and Orissa, Assam, Sind, Hyderabad and Baroda have not suffered from the pest. Replies from Directors of Agriculture of other rice growing provinces are attached (Enclosure II).

3. The subject is now for consideration. It will be first examined by the same sub-committee of the Board as deals with other rice schemes (*vide* Enclosure I). The report of the sub-committee will be submitted to the Board.

ENCLOSURE I.

NOTE FOR THE ADVISORY BOARD, DATED THE 24TH JANUARY 1934.

APPLICATION FROM THE GOVERNMENT OF THE CENTRAL PROVINCES FOR A GRANT OF RS. 10,088 SPREAD OVER FOUR YEARS FOR RESEARCH WORK ON THE "GANGAI" PEST OF RICE—ENTOMOLOGICAL WORK UNDER THE SCHEME OF RICE RESEARCH ALREADY SANCTIONED BY THE COUNCIL FOR THE CENTRAL PROVINCES.

Attention is invited to the attached letter (Annexure I) from the Government of the Central Provinces, No. 48-1052-XIV, dated the 8th January 1934, containing an application for an additional grant under the scheme of rice research in the Central Provinces already sanctioned by the Council (at a total cost of Rs. 1,08,800 spread over 5 years), for entomological work on the "gangai" pest of the rice crop. The scheme involves, so far as the Council is concerned, an expenditure of Rs. 10,088 spread over four years, and is for the consideration of the Advisory Board.

2. The Vice-Chairman to the Council considers that it will be an advantage to have the present scheme examined in the first instance by the Committee which considered the progress reports on rice research schemes at the time of the meeting of the Advisory Board held in August 1933 and which consisted of the following gentlemen :—

1. The Vice-Chairman, Imperial Council of Agricultural Research (Chairman).
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Mr. R. G. Allan, Director of Agriculture, United Provinces.
4. Dr. W. Burns, Director of Agriculture, Bombay.
5. Prof. J. C. Ghosh.
6. Rao Bahadur D. Ananda Rao, Offg. Director of Agriculture, Madras.
7. Mr. D. R. Sethi, Director of Agriculture, Bihar and Orissa.
8. A representative of the Department of Agriculture, Bengal.
9. Dr. F. J. F. Shaw, Imperial Economic Botanist, Imperial Institute of Agricultural Research, Pusa.
10. Rao Bahadur B. Viswanath, Government Agricultural Chemist, Madras.
11. Prof. P. K. Parija, Ravenshaw College, Cuttack.
12. Mr. M. Vaidyanathan, Statistician, Imperial Council of Agricultural Research.

Secretary, Imperial Council of Agricultural Research, Secretary (*ex-officio*).

This Sub-Committee will meet on Tuesday, the 20th February 1934 at 2-45 P.M. in the Conference Room, First Floor, South Block, Imperial Secretariat Buildings, New Delhi. Its report will be circulated to the Advisory Board in due course.

ANNEXURE I.

COPY OF LETTER FROM THE REVENUE SECRETARY, GOVERNMENT OF THE CENTRAL PROVINCES, AGRICULTURE DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 48-1052-XIV, DATED THE 8TH JANUARY 1934.

Grant-in-aid from the Imperial Council of Agricultural Research for certain schemes of Research in the Central Provinces.

I am directed by the Government of the Central Provinces (Ministry of Agriculture) to forward a copy of letter No. 5551, dated the 12th/13th December 1933 (Annexure II) from the Director of Agriculture, Central Provinces, together with the undermentioned six schemes and to recommend them for the favourable consideration of the Imperial Council of Agricultural Research. The schemes are being printed and 150 copies of them will be furnished to you in due course.

* * * * *

- (4) Scheme for research on the Gangai pest of Rice (Annexure III).

* * * * *

2. These schemes have been considered by the Provincial Agricultural Research Committee on the 9th December 1933 and approved by that body. The Local Government has also accepted them. I am accordingly to request that they may be placed before the Advisory Board of the Imperial Council of Agricultural Research at its next meeting to be held in February 1934.

ANNEXURE II.

COPY OF LETTER FROM THE OFFG. DIRECTOR OF AGRICULTURE, CENTRAL PROVINCES, TO THE SECRETARY TO GOVERNMENT, AGRICULTURE DEPARTMENT, CENTRAL PROVINCES, No. 5551, DATED THE 12TH/15TH DECEMBER 1933.

I have the honour to attach herewith six schemes of research which were placed before the Provincial Agricultural Research Committee on the 9th December 1933 and recommended for transmission to the Imperial Council of Agricultural Research for the provision of funds. The Provincial Agricultural Research Committee placed them in the following order of importance :—

Schemes for Research on the Orange Crop.	}	A.
Schemes for Research on Oilseeds.		
Schemes for Research on Potato Storage.	}	B.
Schemes for Research on Gangai Pest of Rice.		
Schemes for Research on Sann Hemp.	}	C.
Schemes for Research on Pan Cultivation.		

* * * * *

The Gangai pest of Rice has made itself very prominent this year in Bilaspur, Mandla and Raipur and areas of other districts. The pest appears to be creeping steadily westwards and if steps are not taken to investigate it and find control measures, the whole of the rice area will become liable to attack. The insect is known to cause damage in Bengal, Bihar and Orissa and Madras, so that the scheme put forward is of All-India importance and thus deserves the support of the Imperial Council of Agricultural Research.

ANNEXURE III.

ADDITIONAL GRANT UNDER THE RICE RESEARCH SCHEME FOR ENTOMOLOGICAL WORK.

Many reports of damage to paddy have been received this year, all due to what is locally called "gangai" or sometimes "ponga". In parts of Bilaspur district and in Mandla, the loss is extensive and the pest appears to be spreading westward and will soon affect the whole of the rice tract.

The Entomologist to Government visited affected areas and identified the insect as (*Pachytiplosis oryzae*) a small mosquito like a fly.

The known methods of dealing with the pest have been recommended, viz., early sowing, fertilizing to obtain vigorous growth before the fly is due to appear about August and the use of light traps.

Little, however, is known about the insect and there are several important points on which information is lacking, *e.g.* :—

- (1) How the insect behaves and how it carries over from crop to crop.
- (2) Has it any alternative food plants during the paddy season ?
- (3) *Kodon* plants were reported to have been similarly damaged. Is the same insect responsible for damage to both crops or are two species concerned ?
- (4) Are any wild grasses found near paddy fields subject to this pest ?
- (5) How can the natural enemies of the pest (many larvae were found parasitized this year) be multiplied and used to the best advantage ?

The Entomologist to Government has to devote his time to teaching and other research work and is unable to carry out this necessary investigation. I therefore apply to the Imperial Council of Agricultural Research for the following staff, etc., to be attached to the Rice Research Scheme for the Central Provinces but to work under the direction and supervision of the Entomologist to Government :—

	First year.	Second year.	Third year.	Fourth year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.
1. Entomological Assistant, Central Provinces Subordinate Service at Rs. 100—5—115.	1,200	1,260	1,320	1,320	5,160
2. Two Fieldmen at Rs. 25 each ..	600	600	600	600	2,400
3. One chaprasi at Rs. 11	132	132	132	132	528
4. Travelling allowance	300	300	300	300	1,200
5. Contingencies	200	200	200	200	800
Total ..	2,432	2,492	2,552	2,612	10,088

Laboratory accommodation, apparatus, etc., will be supplied by the Central Provinces Government and the work, as mentioned above, will be directed and supervised by the Entomologist to Government, Central Provinces.

ENCLOSURE II.

(1)

LETTER FROM THE DIRECTOR OF AGRICULTURE, MADRAS. No. D-1-611-34,
DATED THE 9TH MAY 1934.

'Gangai' or 'Ponga' (if it is *Pachytiplosis Oryzae*) is a well-known paddy pest of South India and is called the 'Silver shoots', 'Anakombu' or 'Kodu' pest in the Tamil Districts. It is a fairly important pest in the province and especially in Malabar, Northern Circars and Southern Districts. The Government Entomologist is of the opinion that points 1 to 4 of the points raised in the scheme are all one—*viz.*, whether the insect breeds on any other host plant which will necessarily help its

breeding all through the year, whether there is paddy growing or not. As far as we are aware, it is known that the insect breeds on at least two grasses other than paddy and this certainly helps the creature to be carried over from season to season or crop to crop.

2. A paper on the same has also been published by Rao Sahib Y. Ramaachandra Rao in the Departmental Year Book for 1925 (pages 6—18). As regards the remedial measures, a few trials made with light traps have met with some success, since they attracted gravid females in fairly large numbers.

(2)

LETTER FROM THE DIRECTOR OF AGRICULTURE, BOMBAY. No. 493-J. OF 1934,
DATED THE 26TH MAY 1934.

In reply to your letter No. F. 57/34-Agr. of 20th April 1934, I have the honour to state that the Gangai pest of rice (*Pachytiplosis oryzae*) is serious in North Kanara where it is known as 'Kane'. It occurs there almost every year and assumes a virulent form once in two or three years. The area subjected to this pest is above 1 lakh of acres and the average damage is estimated to be Rs. 5 lakhs a year.

(3)

LETTER FROM THE DIRECTOR OF AGRICULTURE, BENGAL, No. 16007-A.,
DATED THE 17TH APRIL 1934.

Under Subject No. 33 at the last meeting of the Advisory Board, a scheme was submitted by the Central Provinces for investigation into a paddy pest (*Pachytiplosis oryzae*); and in committee it was suggested that the Council should be informed if this insect was found to be causing damage in other Provinces. I have the honour to inform you that damage has been reported from Bankura district, where the insect is locally known as "Bhenpu". It was confined to transplanted *aman* paddy, principally to late varieties grown on poor land. *Aus* and early *aman* paddies were not seriously affected. The pest has been known for a number of years, but attacks so far have been sporadic and have not reached serious dimensions.

(4)

LETTER FROM THE DIRECTOR OF AGRICULTURE, BENGAL. No. 16791, DATED
THE 3RD MAY 1934.

With reference to paragraph 2 of your letter No. F. 57/34, dated the 20th April 1934, regarding destruction of rice crop by 'Gangai' pest, I have the honour to say that the pest did damage to the extent of about four annas on late *aman* paddy varieties in the Bankura district last year. It is locally known as "Bhenpu". The pest has been known for some time but has never been responsible for wholesale damage.

(5)

LETTER FROM THE DIRECTOR OF AGRICULTURE, BURMA, No. 4541/1-A-76,
DATED THE 24TH MAY 1934.

I have the honour to acknowledge receipt of your letter No. F. 57/34-Agr., dated the 20th April 1934 and to state that the insect "*Pachydi-*

plosis oryzae" was reported in Burma as having occurred in the Shwebo district in 1922, in the Myaungmya jail grounds in 1923-24, in 1929 in the Bhamo district and in 1930 in the Katha district. It usually occurs in restricted areas of comparatively small extent although in these areas the damage may be considerable. On the whole it is to be classified as a minor pest of paddy in Burma.

(6)

LETTER FROM THE DIRECTOR OF AGRICULTURE, CENTRAL PROVINCES,
No. C./77, DATED THE 18TH MAY 1934.

With reference to your endorsement No. F. 57/34-Agri., dated the 20th April 1934, I have the honour to forward herewith copies of correspondence from the Government Entomologist, Madras, and the Entomological Assistant, Bengal, regarding *Pachytiplosis oryzae* which causes the 'Gangai' disease in paddy, from which it will be seen that it is a pest well-known in parts of India other than the Central Provinces.

I also enclose reports from the Deputy Commissioners of the rice growing districts of the Central Provinces showing the extent of the damage done last year by the pest.

EXTRACT FROM D.-O. No. 282/34, DATED THE 15TH APRIL 1934, FROM THE
GOVERNMENT ENTOMOLOGIST, COIMBATORE, TO THE ENTOMOLOGIST
TO GOVERNMENT, CENTRAL PROVINCES, NAGPUR.

Your letter of 5th April regarding paddy gall-fly (*Pachytiplosis oryzae*).

It is a pest in South India and fairly bad in certain seasons.

* * * * *

EXTRACT FROM D.-O. No. 47, DATED THE 11TH APRIL 1934, FROM THE
ENTOMOLOGICAL ASSISTANT, DACCA, TO THE ENTOMOLOGIST, DEPARTMENT
OF AGRICULTURE, CENTRAL PROVINCES, NAGPUR.

* * * * *

Pachytiplosis Oryzae has long been in existence in Western Bengal (Birhum, Bankura, Midnapur, Burdwan and Hooghly). It is bad only in some years on paddy of low lying sandy or insufficiently manured soil. Last year it was reported from a part of Bankura District where it did about 2 annas damage. It generally appears on paddy standing on water in August and finishes the damage in a short time.

* * * * *

MEMORANDUM FROM THE DEPUTY COMMISSIONER, BHANDARA, TO THE
COMMISSIONER, CHHATTISGARH DIVISION, RAIPUR, No. 187-A., DATED
THE 16TH APRIL 1934.

With reference to your endorsement No. 422-A., dated the 11th April 1934 for report copy of memorandum No. 1494, dated the 10th idem, from

the Director of Agriculture, Central Provinces, to his address, I have to say that there was no damage done to rice by Gangai Pest in this district this year and no suspension or remission of Land Revenue was granted on this account.

MEMORANDUM FROM THE DEPUTY COMMISSIONER, RAIPUR, TO THE COMMISSIONER, CHHATTISGARH DIVISION, RAIPUR, DATED THE 18TH APRIL, 1934.

I forward herewith a copy of Superintendent, Land Record's note, dated the 26th October 1933, together with a copy of my memorandum No. 41, dated the 19th January 1934, to the Secretary to Government, Revenue Department. These memoranda contain all the information required by the Director of Agriculture.

With reference to the damage by "Gangai" in the District I beg to say that the Gangai which appeared before the crop is now disappearing at places and actual dhan is covering the field. However the damage caused will be serious in some of the villages of the District. So far the report shows this has appeared on both sides of Raipur-Baloda Bazar road to a breadth of about five miles or so and has extended to patwari circle 86, 87, 89, 97 near Pallari. It has changed its course near Baloda Bazar to Laon. In villages along and by the side of this road there is any appreciable damage which may be from 8 annas to 10 annas. In Gudhari circle damage is estimated in about 330 acres in four villages. Kharora is about 1,170 acres in nine villages.

In Baloda Bazar in Kosmandi circle damage is reported in two villages in about 95 acres.

In Kosmandi circle in 28 villages to the extent of 4,545 acres, Sudhiela circle in 71 villages in 4,792 acres.

In rest of the district there is not much damage but the district outturn will be affected to 1 anna or so. The Revenue Inspectors have been ordered to perform ten crop experiments in their circles and the Patwaris of these circles have been ordered to perform at least two experiments in each village in their charge. In my humble opinion it will be desirable if other revenue officers are also ordered to perform certain number of crop experiments in these circles as a special case along with other experiments in other Revenue Inspectors circles.

MEMORANDUM FROM THE DEPUTY COMMISSIONER, RAIPUR, TO THE GOVERNMENT OF THE CENTRAL PROVINCES, No. 41, DATED THE 19TH JANUARY 1934.

In September last the paddy crop in the following eleven villages of the Raipur and Baloda Bazar Tahsils was found to have been affected by Gallstem flies. Field to field enquiries made showed that the outturn of the fields sown by several tenants was less than 6 annas. A sum of Rs. 322-9-7 on account of rents due by the tenants as well as the proportionate land revenue amounting to Rs. 162 as detailed below has

therefore been remitted in accordance with the instructions contained in paragraph 24 of Revenue Book Circular I-9 :—

Raipur Tahsil.

				Rs.	A.	P.
1. Sakri	..	..	..	5	13	0
2. Amlitalao	..	..	..	0	6	0
3. Dhansuli	..	..	..	32	1	0
4. Amsena	..	..	..	12	1	0
5. Chikhli	..	..	..	16	13	0
6. Kutela	..	..	..	0	14	0
7. Seoni	..	..	..	1	1	0
8. Amaseoni	..	..	..	76	10	0
Total				..	145	11 0

Baloda Bazar Tahsil.

9. Mohgaon	..	..	..	5	6	0
10. Koiha	..	..	..	9	14	0
11. Gidhpuri	..	..	..	1	1	0
Total				..	16	5 0
GRAND TOTAL				..	162	0 0

MEMORANDUM FROM THE DEPUTY COMMISSIONER, BALAGHAT, TO THE COMMISSIONER, CHHATTISGARH DIVISION, RAIPUR. No. 189-A., DATED THE 22ND APRIL 1934.

There was no damage in this district.

MEMORANDUM FROM THE DEPUTY COMMISSIONER, DRUG, TO THE COMMISSIONER, CHHATTISGARH DIVISION, RAIPUR. No. 15-C., DATED THE 30TH APRIL 1934.

No damage to rice crop was done by Gangai pest in the Drug and Balod tahsils of this district. Some of the fields in one Revenue Inspector's circle of the Bemetara tahsil were, however, affected by the pest ; but the damage done is estimated to be not more than 2 annas to 3 annas. There was no need to grant any suspension or remission and none was granted.

MEMORANDUM FROM THE DEPUTY COMMISSIONER, BILASPUR, TO THE COMMISSIONER, CHHATTISGARH DIVISION, RAIPUR. No. 184-A., DATED THE 7TH MAY 1934.

As soon as it became known that Gangai pest had caused damage to the paddy crops in this district, Sub-Divisional Officers and Tahsildars

were sent out to make enquiries by extensive tours and performing as large a number of crop experiments as was possible. These enquiries disclosed as below :—

In the Janjgir Tahsil the damage ranged between 3 annas to 6 annas in P. C. Nos. 186, 170, 171, 174, 189, 190 and 188. In the remaining Tahsil it was less than 3 annas. In the Bilaspur tahsil the damage was between 1 anna to 6 annas in the tract between Misturi P. C. 134 and Pachpedi P. C. No. 144 and in village Dighora in P. C. No. 57 and 1 anna to 4 annas in the tract to the north of Kota Lormi road, and that between Ratanpur P. C. No. 130 and Nargoda P. C. No. 125. In the remaining portion of the Tahsil the damage ranged up to 3 annas. In the Mungeli Tahsil, the villages in the Patharia R. I. Circle suffered to the extent of 5 annas while in the remaining portion of the Tahsil the crop was 14 annas. In the Katghora Tahsil the damage was not more than 3 annas on an average.

3. On the whole, though the damage caused was somewhat over an extensive area in the District it was not more than 6 annas and was not such as to call for any relief in the nature of suspension or remission of land revenue.

DEMI OFFICIAL LETTER FROM THE DEPUTY COMMISSIONER, MANDLA, TO THE DIRECTOR OF AGRICULTURE, CENTRAL PROVINCES, DATED THE 14TH MAY 1934.

With reference to your demi-official No. C.56, dated the 30th April 1934, I write to inform you that subsequent to the appearance of the 'Gangai' disease in this district the climatic conditions became so favourable as to enable the plants to recover considerably. The ultimate damage to crops was not such as to reduce the outturn to the extent of bringing any holding within the relief limit. Hence no relief was necessitated. But damage was definitely caused by the 'Gangai' disease and the outturn was less than what it would have been had there been no disease. Roughly speaking the outturn was reduced by 4 annas in the affected fields.

(7)

LETTER FROM THE DIRECTOR OF AGRICULTURE, CENTRAL PROVINCES, No. C. 86, DATED THE 26TH MAY 1934.

In continuation of my letter No. C.77, dated the 18th of May 1934, I have the honour to forward herewith two more extracts from letters received on the subject of *Pachydictyosia Oryzae*, from the Assistant Director of Agriculture, In-charge, Chhota-Nagpur Range, Kanke, and the Deputy Director of Agriculture, Orissa Range.

EXTRACT FROM LETTER No. 1330, DATED THE 23RD APRIL 1934, FROM THE ASSISTANT DIRECTOR OF AGRICULTURE, IN-CHARGE, CHOTA-NAGPUR RANGE, KANKE, TO THE ENTOMOLOGIST, DEPARTMENT OF AGRICULTURE, CENTRAL PROVINCES.

As far as I can gather from records no serious appearance of this pest which goes under the local name of "Sanhra" or "Sarha" or "Sandha" is reported before 1932 when the pest appeared in Khunti

Sub-division of the Ranehi district. The following year it made its appearance again in the same sub-division and other places.

EXTRACT FROM D.O. No. 3806, DATED THE 9TH MAY 1934, FROM THE DEPUTY DIRECTOR OF AGRICULTURE, ORISSA RANGE, TO THE ENTOMOLOGIST, DEPARTMENT OF AGRICULTURE, CENTRAL PROVINCES.

As regards *Pachydiplosis Oryzae* it is ordinarily not very common in Orissa. But last year immediately after heavy floods and in consequence of rains there was an unusual influx of various insect pests on paddy and rabi crops as well. Rice stem fly was *very bad* in Sambalpur and Angul districts, and considerably reduced the yield in general. It was not so in the coastal districts, though Balasore suffered to some extent.

(8)

LETTER FROM THE DIRECTOR OF AGRICULTURE IN MYSORE, No. Roc.-2673-Sc.-272/33-34, DATED THE 8TH MAY 1934.

With reference to your letter No. F. 67/34/Agri., dated 20th April 1934, I have the honour to state that this pest referred to locally as the "Kalabe Roga" (Silver shoot disease) of paddy occurred last year as a very serious pest of late sown paddy in some of the paddy fields in the Mysore District, when the loss of crop in certain fields was over 60 per cent. The first time it was noticed as a very serious pest in the Mysore State was over 32 years ago (1901-02). Although the insects have been noticed to damage some stray plants in the paddy areas, it has not been noticed as a pest in the intervening period. It remains to be seen whether it is going to appear as a pest this cold weather.

APPENDIX XXXI-A.

NOTE, DATED THE 6TH SEPTEMBER 1934, ON SUBJECT No. 32, SCHEME FOR THE INVESTIGATION OF THE 'GANGAI' PEST OF RICE.

The report of the Sub-Committee on the scheme has already been adopted by the Board. The Director, Imperial Institute of Agricultural Research, has now furnished the promised scheme which is now for the consideration of the Board (Enclosure—scheme).

* * * * *

7. *Scheme for investigating the 'gangai' pest of rice.*—At a meeting of the rice sub-committee of the Advisory Board held on the 3rd September the sub-committee suggested that the Director, Imperial Institute of Agricultural Research, Pusa, should put before the Council a proposal for investigating the 'gangai' pest of paddy by the Entomological Section of the Institute. The sub-committee also suggested that the Director, Imperial Institute of Agricultural Research, should put forward his proposal for any small financial assistance necessary mainly to cover the cost of travelling allowance.

I propose that this work be undertaken by Mr. Isaac, Second Entomologist; he will require the assistance of one fieldman and one laboratory attendant. Any other assistance which he may require can be provided by the local Agricultural Department.

Assuming that Mr. Isaac and the staff will require to visit the Central Provinces on 3 occasions for periods totalling 6 months I estimate that the cost of travelling allowance will amount to Rs. 3,000. Provision should be made in the first instance for the work to be completed in 2 years. A total grant of Rs. 6,000 will therefore be required. Should the work be completed earlier there will be a proportionate saving.

Estimate.

Recurring expenditure.—

	Rs.
1st year—travelling allowance	3,000
2nd year—travelling allowance	3,000
	6,000

F. J. F. SHAW.

The 5th September 1934.

APPENDIX XXXII.

REPORT OF THE TOBACCO SUB-COMMITTEE HELD ON 4TH SEPTEMBER 1934.

PRESENT :

Diwan Bahadur Sir T. Vijayaraghavacharya (*Chairman*),
 Dr. W. Burns,
 Mr. B. C. Burt,
 Mr. Carbery,
 Mr. A. P. Cliff,
 Mr. L. F. Cocks,
 Khan Bahadur Maulvi Fateh-ud-Din,
 Mr. K. Gopalkrishna Raju,
 Mr. C. K. Inamdar,
 Mr. A. M. Livingstone,
 Mr. J. D. Mahendra,
 Mr. A. McKerral,
 Mr. B. S. Patel,
 Mr. C. V. Sane,
 Mr. K. S. Sankaran Pillai,
 Dr. F. J. F. Shaw.

The draft agenda was adopted.

2. The Sub-Committee discussed the questions of :—

- (i) a research programme on tobacco for the Council, having due regard to the scheme already sanctioned and to the need for further work on other types of tobacco and in the provinces, and
- (ii) the formulation of a co-ordinated programme of tobacco research in India. After a careful examination of the data placed before it including the recommendations of the Crop-planning Conference the Sub-Committee decided that efforts should be concentrated in the first place on research and experimental work on cigarette tobacco. It was decided to recommend to the Advisory Board that the sanction given to the scheme for a Cigar Tobacco Expert for Madras and Bengal (to which funds had not yet been allotted) should be withdrawn and such funds as are available devoted to work on the cigarette type of tobacco, it being open to any Local Government particularly interested in the cigar tobacco industry to come up with a separate scheme for research work on this type if it so desired. In coming to the decision the Committee was influenced by the information that the urgency for an expert curer in Bengal had passed and that the scheme as sanctioned would be of little help to Burma.

3. Recent developments in the production of bright flue-cured tobacco suitable for cigarettes in India were briefly reviewed. Practical progress has been almost entirely limited to the Guntur district in the Madras Presidency where there are now over 2,000 flue-curing barns. In North Bihar, leaf of excellent colour and texture has been produced from acclimatised American seed but it has been found impossible hitherto to get rid of the strong flavour which renders Bihar tobacco unsuitable even for blending. Virginia tobacco of excellent quality has been grown in the Saharanpur District of the United Provinces, as a monsoon crop, but this proved to be uneconomic owing to the 'Spot' disease. The production of cigarette tobacco as a *rabi* crop in the United Provinces has not been studied in detail but the long period of intense dryness at the harvest period presents difficulties. Some promising preliminary results have been obtained in the Kaira district of the Bombay Presidency.

4. It was decided that the question of flavour must be tackled first as there appears to be no difficulty in securing the necessary colour and texture. This calls for a chemical investigation of the composition of cured tobacco leaf for which it is desirable that two standard imported types—*Adcock* and 'Harrisons Special' should be grown under a variety of conditions. In particular the effect of soil and manure on flavour must be determined. It was agreed that a special Tobacco Sub-station of the Imperial Institute of Agricultural Research is required and that it should be established at Guntur in the Madras Presidency where tobacco of good flavour is produced commercially. At the Sub-station work could be carried out with soils brought from other parts of India and the effect of manures, etc., on quality could be fully studied. The Director, Imperial Institute of Agricultural Research, undertook to prepare and submit a scheme.

5. The Sub-Committee also decided to recommend to the Advisory Board for sanction the proposal made by the Imperial Economic Botanist in his note, *viz.*, that a pair of flue-curing barns and a trained Curer should be provided in each of the several provinces to permit of work on a co-operative programme. Each pair of flue-curing barns would cost about Rs. 2,500 and it was suggested that these should be provided in the following provinces :—

Bombay, Bihar (Sabour), Burma, Bengal, United Provinces, if a suitable district can be found and also one barn at Baroda to supplement the one already existing.

Each province would be expected to send a suitable man to Pusa for training in tobacco curing. The working expenses of the barns should be met by the provincial Agricultural Department as in every case they would be erected at an experimental farm where tobacco is grown. For the co-operative experiments, seed of a standard type would be issued by the Imperial Institute of Agricultural Research. The general object of the sub-station and of the co-operative scheme of research would be to ascertain in what areas the cultivation of cigarette tobacco could be extended.

6. *Subject 4.—Steps other than research for the encouragement of the production of cigarette tobacco in India.*—Pending the results of the research schemes referred to above the Sub-Committee was unable to

recommend any other measures than those which each Agricultural Department will naturally undertake as part of its usual work. The question of improved marketing must await the result of the marketing surveys.

Subject 5.—Detailed statistics of tobacco production in India.—The question was considered whether special statistics could be obtained for those districts which produce the types of tobacco (including 'heavy' or pipe tobaccos) which are exported or are suitable for export. It was stated that the Guntur district of the Madras Presidency was much the most important area; other possible areas were the Kaira district of Bombay and also Nadiad district of that Presidency and possibly some districts in Hyderabad. It was agreed that the matter should be examined further by the Secretariat of the Council.

Subject 6.—Proposal for the appointment of a Central Tobacco Committee.—In the opinion of the Sub-Committee there is no necessity for a Central Tobacco Committee at present until the results of the research schemes now recommended are available, an advisory sub-committee of the Council should be sufficient. The question of the publication of marketing intelligence was considered and it was decided that this also should wait the result of the market surveys.

Subject 7.—Application from the Andhra University for a grant of Rs. 1,000 for a scheme to find out the best method of extracting nicotine commercially from tobacco waste and to design an apparatus for the same. (Appendix XXXIII).—The Sub-Committee was informed that some experimental work on these lines is being carried out by the Industrial Chemist, Bombay. It therefore recommends that the Bombay Industrial Department should be requested to supply any information available and that the application be further considered at a future meeting.

B. C. BURT,
Agricultural Expert.

SIMLA,

The 5th September 1934.

APPENDIX XXXII-A.

AGENDA FOR THE FIRST MEETING OF THE TOBACCO COMMITTEE, 4TH SEPTEMBER 1934.

1. Consideration of the Agenda.
2. Research programme on Tobacco, having due regard to the scheme of work already sanctioned and to the need for further work on other types of Tobacco and in the provinces.
3. Formulation of a co-ordinated programme of agricultural research for the improvement of the Tobacco crop in India.
4. In view of the need for encouraging alternative cash crops, to consider what steps should be taken to encourage the greater production of cigarette tobacco in India in order to take advantage both of the large internal market and of the valuable Imperial preference in the United Kingdom which is guaranteed till 1942.
5. Possibility of obtaining detailed statistics of tobacco production in India.
6. Proposal for the appointment of a Central Tobacco Committee.
7. Application from the Andhra University for a grant of Rs. 1,000 for a Scheme to find out the best method of extracting nicotine commercially from tobacco waste and to design an apparatus for the same (subject No. 35 of the Agenda for the meeting of the Advisory Board, September 1934). Please see Appendix XXXI.

APPENDIX XXXIII.

NOTE, DATED THE 26TH MAY 1934, ON SUBJECT No. 35, APPLICATION FROM THE ANDHRA UNIVERSITY FOR A GRANT OF Rs. 1,000 FOR A SCHEME TO FIND OUT THE BEST METHOD OF EXTRACTING NICOTINE COMMERCIALY FROM TOBACCO WASTE AND TO DESIGN AN APPARATUS FOR THE SAME.

Attention is invited to the attached letter from the Government of Madras, No. 446-Ms., dated the 4th April 1934 (Enclosure) forwarded *inter alia* the Scheme mentioned above. The scheme which involves an expenditure of Rs. 1,000 is now for the consideration of the Advisory Board.

 ENCLOSURE.

COPY OF A LETTER FROM THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 446-Ms., DATED THE 4TH APRIL 1934.

ANDHRA UNIVERSITY SCHEMES.

I am directed to forward the following schemes submitted by the Registrar, Andhra University, Waltair, for financial assistance from the Council :—

1. * * * *
2. * * * *

3. Technology of tobacco waste.

(2) The Schemes were circulated to the members of the Provincial Research Committee. The first scheme has been recommended by four members, the second by three and the third by six including the Director of Agriculture. In the opinion of the Local Government, however, none of the schemes are deserving of financial aid from the Council.

 III.

A SCHEME BY DR. N. R. DAMLE, M.Sc., Ph.D., LECTURER IN CHEMICAL TECHNOLOGY, JEYPORE VIKRAMA DEO COLLEGE OF SCIENCE AND TECHNOLOGY, WALTAIR, FOR A GRANT FROM THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

Technology of Tobacco Waste.

There is available large amount of tobacco waste in Guntur district and adjoining districts in the Andhra country. It is possible to extract from it "Nicotine" which is a valuable material greatly in demand for spraying on fruit trees as an insecticide. It is contemplated to do some work on the subject, to find out the best method of extracting nicotine commercially and to design an apparatus for the same. A semi-large scale plant to deal with about 100 lbs. of tobacco waste at a time would be built in the department in order to be able to get complete data on the subject.

The expenses required for carrying on the above work would be about Rs. 1,000.

Qualifications, etc., of the applicant.

1. Passed in 1921 the B.Sc. of the University of Bombay with distinction with Chemistry and Physics—obtained the rank of first in first class.

2. Joined the Indian Institute of Science as Bombay Government Scholar for the study of the Chemistry and Technology of oils and fats under Dr. Sudborough. After undergoing a thorough grounding in the various technical subjects such as refining, hydrogenation and hydrolysis of the oils and fats, was engaged in the following problems of research. The papers embodying the results have now been published in the Institute Journal :—

- (1) Constitution of rape oil (Jour. ; Ind. Inst. of Science, 9-A, Part II, page 26).
- (2) Oil from *Tropeolum majus* seeds—*ibid.*, page 65.
- (3) The preparation of pure behenic acid.
- (4) Solidifying point curves of mixture of several fatty acids and esters.

Was awarded the A.I.I.Sc. of the Institute and the M.Sc. of the University of Bombay in 1924 for the thesis embodying the above pieces of research.

3. Proceeded to England in 1925 with University Scholarship and joined the Chemical Engineering Department of the University College, London. After completing the course of lectures and experiments in Chemical Engineering, worked under the guidance of Professor Gibbs on the "Heat of absorption by silica Gel" in view of the great technical and theoretical importance of the subject. Developed a special apparatus for the purpose and obtained results of considerable interest. These formed the subjects of thesis for the Doctorate of Philosophy of the University of London in 1931. While in London studied the Technology of Rubber in the Northern Polytechnic for one year. Also visited numerous factories in England and abroad with a view to study the details.

After return to India in 1932, has occupied himself with numerous industrial problems with promising results. Among these several such as the manufacture of anhydrous sodium sulphate required in the mill industries, the manufacture of ammonium chloride, magnesium sulphate, etc., have attracted the attention of the capitalists in Bombay after demonstration of the work on a semi-commercial scale and a large scale plant has been erected for anhydrous sodium sulphate.

Also designed and built a semi large scale plant for the manufacture of sulphuric acid by using vanadium catalysts in the Indian Institute of Science.

Was for some time the chief chemist and Chemical Engineer to the Karnatic Chemical Works. Was responsible for erecting plants for the manufacture of soap and for the solvent process of extraction of oil from Dhupa.

APPENDIX XXXIV.

NOTE, DATED THE 5TH JULY 1934, ON SUBJECT No. 22, APPLICATION FROM MR. J. J. DEVALOIS, PRINCIPAL, AMERICAN ARCOT MISSION AGRICULTURE INSTITUTE, KATPADI, MADRAS, FOR A GRANT OF Rs. 78,876 FOR GOAT BREEDING IN THE MADRAS PRESIDENCY SPREAD OVER A PERIOD OF TEN YEARS.

Attention is invited to the letter from the Government of Madras No. 635 dated the 11th May 1934 (Annexure I) forwarding a scheme for research in goat breeding (Annexure II). The Scheme is estimated to cost Rs. 78,876 (Rs. 5,490 non-recurring and Rs. 73,386 recurring) spread over a period of ten years. Against this cost there is an estimated income of Rs. 22,415 reducing the total cost to a net amount to Rs. 56,461. The land and building will be provided by the American Arcot Mission and the Principal of the Agriculture Institute will supervise the work free of cost.

The Provincial Research Committee and the Government of Madras have recommended the scheme.

2. Attention is also invited to the extract (Annexure III) from the proceedings of the meeting of the committee which considered the goat and sheep breeding schemes submitted to the Board at the August 1933 meeting by the Government of Bombay and His Exalted Highness the Nizam's Government.

3. The subject is now for the consideration of the Advisory Board.

ANNEXURE I.

COPY OF A LETTER FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 635, DATED THE 11TH MAY 1934.

SUBJECT.—*Scheme of research on Goat Breeding.*

Reference:—Your letter No. D. 1034-V/33, dated the 11th December 1933.

I am directed to enclose a copy of the scheme of research on Goat breeding submitted by Mr. J. J. DeValois of the Agricultural Institute, Katpadi, revised on the lines indicated in the note of the Animal Husbandry Expert to the Council. A further note on the scheme by Mr. DeValois is also enclosed.

2. The Provincial Research Committee and the Local Government recommend the scheme for the consideration of the Council.

3. 150 printed copies will be forwarded in due course.

ANNEXURE II.

LETTER FROM J. J. DEVALOIS, Esq., B.Sc., PRINCIPAL, AGRICULTURAL INSTITUTE, KATPADI, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH (THROUGH THE SECRETARY TO GOVERNMENT, DEVELOPMENT DEPARTMENT), DATED KATPADI, THE 15TH FEBRUARY 1934.

[*Scheme of research in goat breeding—Presented by me on 6th June 1933—Revised in accordance with suggestions made by the Animal Husbandry Expert to the Imperial Council.*]

I am enclosing the revised scheme drawn up with the suggestions of making it deal only with pure-bred stock of the Jumna-Pari and Surti

breeds extending over a period of ten years with the intention of having 100 females of each breed to experiment with.

In making this revised statement, I had for reference the work of the Mission Poultry Farm, Etah, United Provinces, and the Bombay and Poona sheep and goat experiment proposals. You will note that the total grant applied for is Rs. 52,501 spread over a period of ten years, as seen in Appendix B, Final Summary.

Kindly acknowledge receipt of the Scheme. Trusting that the matter may receive your sympathetic and favourable consideration.

ENCLOSURE.

RESEARCH WORK IN GOAT BREEDING.

Details of the research work proposed to be carried out by the American Arcot Mission Agricultural Institute, Katpadi, North Arcot District, Madras Presidency, with the subsidy asked for from the Imperial Council of Agricultural Research.

INTRODUCTION.

In connexion with my activities in rural reconstruction in the villages of South India the past twelve years, I have been impressed with the fact that the depressed classes and smaller village ryots find it almost impossible to raise and maintain a decent breed of milk cattle. They cannot afford the initial outlay nor take the chances on mortality resulting from the numerous diseases and difficulties arising from present village conditions and communal grazing. As milk is such an essential item in the diet, I am persuaded that the goat, the "poor man's cow" should receive more attention. The goats, as found in the South Indian villages, are of a very poor grade. No systematic improvement work has yet been undertaken by any agency either official or non-official. Much prejudice exists against the use of goat milk which can only be broken down by a vigorous educational programme with actual demonstrations.

From extensive inquiries we find that there are indigenous Indian goats that give promise of being valuable milk and dual purpose animals such as the Jumna-Pari in the United Provinces and the Surti found in the Bombay Presidency. Our proposal is to introduce these two breeds into South India and by selective breeding, progeny tests together with a careful system of records to determine what possibilities such may hold for conditions in South India.

LINES OF RESEARCH.

Our object would be to follow three main lines of research :—

- (1) Selective breeding of the best Jumna-Pari goats by means of recorded milk yields and progeny tests to determine their adaptability to South India.
- (2) Same as above for Surtis.
- (3) Observation of results obtained by crossing Surti and Jumna-Pari males with local females as to any increase in milk yield obtained, suitability for town and village conditions of both breeds and the resulting carcass of the offspring compared with the native goats. Our plan would be to keep our stock at the farm pure but have the cross-breeding done by the use

of our males with those kept and owned by local village and town people.

OBJECTS OF THE EXPERIMENT.

Careful records will be kept covering the following :—

- (1) Comparative milk production of pure-bred Jumna-Pari and Surtis.
- (2) Comparative hardiness and prolificacy of the two breeds.
- (3) Age of maturity in each breed.
- (4) Milking longevity.
- (5) Comparison of average interval between kiddings.
- (6) The estimated average value of hair, hide and carcass.
- (7) Suitability of various concentrated feeds and fodder for goat-raising in South India.
- (8) Observation of diseases of goats and their treatment under the supervision of the Madras Veterinary Department.

DETAILS OF EXPENDITURE.

1. *Staff*.—(a) Mr. J. J. DeValois, B.Sc., in Agriculture and Animal Husbandry of Iowa State College, with special training in genetics, live-stock breeding, judging and feeding, will supervise the research work. Mr. DeValois has had thirteen years' experience with Indian conditions. This supervision to be given free by the Mission.

(b) An Indian Dairy Diploma or Agricultural College graduate assistant, on a Rs. 80—4—100 scale.

(c) One clerk on Rs. 30—2—40 (from second year).

(d) One maistry or head shepherd on Rs. 25.

(e) Unskilled labourers to care for the flock. Four men, the first three years and six the last seven years of the experiment at Rs. 12 per month each.

2. *Livestock*.—(a) Two Jumna-Pari males and 40 females to be imported from North India.

(b) Two Surti males and 40 females to be imported from West India.

Personal selection of the above will be made so that the estimated per animal unit cost would be Rs. 50 including the buying price of the goats *plus* shipping expenses. Eighty-four animals would thus net Rs. 4,200 initial cost. This foundation herd will be increased to 100 females and four males for each of the two breeds. In addition, considerable data will be available within ten years from cross-bred animals kept by local town and village people to whom some select males will be given for stud purposes.

3. *Buildings*.—The Imperial Council has intimated that they will not be in a position to grant any assistance for buildings. The Madras Government has been consulted as to the possibility of a grant for this purpose but possibilities are that nothing may be available at the present time. We hope that later the Local Government may find it possible to assist us if it can possibly do so in view of the fact that this experiment will be of great value for South India. For the present, the Agricultural Institute is

prepared to build the necessary buildings in an inexpensive manner yet suitable for the carrying on of the work in a sanitary and efficient way which will also be a good demonstration for village farmers who, we hope, will take to this branch of livestock work following our example.

The following buildings will be required :—

- (1) House for the Indian graduate assistant and clerk ; quarters for maistri and coolies.
- (2) Main goat shed for the milking herd.
- (3) Separate sheds for males which can also be used as serving pens.
- (4) Shed for the dry herd, goatlings and kids.
- (5) Isolation shed and sick room.
- (6) Dairy shed and office.
- (7) Fencing for runs and paddocks.

4. *Equipment*.—(a) Office requirements, i.e., tables, chairs, almirahs, desks, typewriter, filing cabinets, etc.

(b) Dairy equipment—weighing scale, spring-balance scales, milk cans, strainers, measures, thermometers, babcock testor, castrator, collars and chains, number tags and tattoo marker, medicines and surgical supplies.

5. *Land*.—In 1922, the Government of Madras alienated to the Arcot Mission, 175 acres of land to be utilized for an agricultural school and demonstration farm. Of this area, about 50 acres has been brought under cultivation, 35 acres has been devoted to buildings, school, playground, poultry runs, etc., leaving a considerable area for grazing purposes which can well be utilized for paddocks and grazing for the goat herd. About 2 acres of fodder crops will have to be grown.

6. *Maintenance charges*.—(a) Concentrated feeds, fodder and grazing charges to be estimated at Rs. 18 per adult goat per year and Rs. 12 per kid and goatling per year. These estimates are based on actual costs at the Mission Poultry Farm, United Provinces.

	<i>Per year.</i>
	Rs.
(b) Recurring office and farm contingencies :—	
(1) Books, periodicals, stationery, stamps, etc. ..	150
(2) Dairy expenses	50
(3) Veterinary fees (we would attempt to have an agreement with the local hospital at Vellore for a monthly allowance of Rs. 10) ..	120
(4) Medicines and veterinary supplies	100
(5) Repairs to buildings, fences, etc.	100
(6) Miscellaneous expenses	100
Total ..	620

DETAILS OF INCOME EXPECTED.

Rs.

- (1) *By sale of milk.*—As the Agricultural Institute is located 10 miles from Vellore, the nearest city where milk can be sold in large quantities, there will be considerable difficulty in managing this item. We, therefore, assume that it will not be possible to realize more than an average of Rs. 6 per year from each adult female in the herd. Our first aim will be to allow the young kids all the milk they can manage. We assume that there will be 80 adult females the first year ; 100 the second year ; 150 the third year and 200 for each of the remaining seven years of the experiment making 1,730 animal units and Rs. 10,380 income 10,380
- (2) *By sale of stock during the ten-year experiment—*
- (a) *Male kids.*—These will be disposed of at the age of six months ordinarily at an estimated average price of Rs. 4. It is estimated that we will be able to dispose 40, 50 and 75 in the second, third and fourth years, respectively, and 100 each of the last six years of the experiment. This would make 765 head or Rs. 3,060 from this item 3,060
- (b) *Culled does and young female kids.*—Females that fail to measure up to our standards will be culled. Some of the doe kids that fail to show promise or are slightly defective will also be sold. It is estimated that we would have 20 such animals the second and fourth years and 80 each of the last six years of the trial. We should be able to sell these at Rs. 7-8-0 each on the average making a total of Rs. 3,900 from the 520 animals so disposed of 3,900
- (c) *Better grade females.*—In order to keep our flock within the limit of 100 adult females for each breed, we estimate that we will have five better grade females the fourth year and 20 each of the last six years that we should be able to dispose of at Rs. 15 per animal making Rs. 1,875 for the 125 animal units 1,875
- (3) *Sale of stock at the end of the experiment.*—We should have 200 females worth Rs. 15 each and eight males worth Rs. 25 each making a total of Rs. 3,200 income at the conclusion of the experiment 3,200

Total 22,415

CONCLUSION.

The Agricultural Institute is located 4 miles from the Katpadi Railway station quite accessible to the public who would be interested in following the results of the goat-breeding experiment. The Agricultural Institute is already carrying on an extensive poultry farm drawing a large number of visitors. Many other crops and livestock projects are also being demonstrated to the public, such as the breeding of Kangayam and Scindhi cattle, pig raising, mango grafting and fruit farming, vegetable growing, etc. In all this work we are receiving the hearty co-operation and assistance of the Madras Agricultural Department.

Associated with the Demonstration Farm is a boys' boarding home with 80 students and a central village school together forming a higher elementary school of 130 students which also receives the hearty co-operation of the Educational Department and is well subsidized by them. All these students take work in Agriculture giving their literary training a practical bias. These boys are all in training for village work and would be greatly interested in the experiment as well as being in a position later to introduce the improved breed of goats into their villages.

A Rural Reconstruction Summer School is also held at the Agricultural Institute yearly which is attended by 50 or more students. The advantages of goat raising would be demonstrated to these leaders. The institute also carries a staff of extension workers who go into the district demonstrating improved agricultural practices on the ryots' own lands in the village. The Arcot mission also has occupied 250 villages in each of which is stationed one or more teachers also serving the purpose of working for village uplift. Considerable work is also being carried on through lectures and contacts with taluk and district board schools. So far as time and money allows the institute attempts to spread its influence for rural improvement without prejudice to caste or creed. The objective would ultimately be to supply pedigreed breeding stock for our own rural reconstruction units as well as to make them available for other public or private bodies in the South Indian Provinces for goat improvement work.

The Arcot mission is prepared to give the services of Mr. J. J. DeValois, the Principal of the Agricultural Institute, Katpadi, free to supervise this project which will entail considerable time and attention. We are also prepared to make available the necessary buildings, land, housing arrangements for staff in the interests of the experiment. We hope that this will ultimately be of great benefit to the many goat breeders in India and especially so for the poorer classes of people, Christian and non-Christian who will be taught the value of utilizing the products of the "poor man's cow".

We therefore appeal to the Imperial Council of Agricultural Research to favourably consider this scheme and place the necessary funds at our disposal to be used along with our local contribution for the research work on goats for South Indian Provinces its ultimate extension into village work if the experiment proves the desirability of so doing. We can assure the council that the work will be done with great care and in full co-operation with the Madras Agricultural and Veterinary Departments who have always assisted us so generously.

APPENDIX A.

Summary of Expenditure.

	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.	Seventh year.	Eighth year.	Ninth year.	Tenth year.	Total.	
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
I Capital Expenditure—												
1 Purchase of 84 goats ..	4,200	..	..	..	..	..	..	..	..	..	4,200
2 Office equipment ..	690	..	..	..	..	..	..	..	..	..	690
3 Dairy equipment ..	600	..	..	..	..	..	..	..	..	..	600
Total ..	5,490	..	..	..	..	..	..	..	..	..	5,490
II Staff—												
1 Graduate Assistant ..	960	1,008	1,056	1,104	1,152	1,200	1,200	1,200	1,200	1,200	11,280	
2 Clerk ..	..	360	384	408	432	456	480	480	480	480	3,960
3 Maistri or shepherd ..	300	300	300	300	300	300	300	300	300	300	3,000	
4 Coolies ..	576	576	576	574	574	574	574	574	574	574	7,846	
Total ..	1,836	2,244	2,316	2,686	2,758	2,854	2,854	2,854	2,854	2,854	26,086	
	Number.	Cost.	Number.	Cost.	Number.	Cost.	Number.	Cost.	Number.	Cost.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.
III Feeding charges—												
1 Adult males at Rs. 18	4	72	4	72	6	108	8	144	8	144	8	144
2 Adult females at Rs. 18	8	1,440	100	1,800	150	2,700	200	3,600	300	3,900	300	3,600
3 Kids and goatlings at Rs. 12.	20	240	30	360	25	300	50	600	100	1,200	100	1,200
Total	1,752	..	2,232	..	3,108	..	4,344	..	4,944	..	4,944
	Number.	Cost.	Number.	Cost.	Number.	Cost.	Number.	Cost.	Number.	Cost.	Total.	
	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)		(22)	
		Rs.		Rs.		Rs.		Rs.		Rs.	Rs.	
III Feeding charges—cont.												
1 Adult males at Rs. 18	8	144	8	144	8	144	8	144	8	144	1,260	
2 Adult males at Rs. 18	300	3,600	300	3,600	300	3,600	300	3,600	300	3,600	31,140	
3 Kids and goatlings at Rs. 12.	100	1,200	100	1,200	100	1,200	100	1,200	100	1,200	8,700	
Total ..	..	4,944	..	4,944	..	4,944	..	4,944	..	4,944	41,100
IV Office, etc. 620 620 620 620 620 620 620 620 620 620 6,200												
V Total yearly expenditure—												
1 Capital expenditure ..	5,490	..	..	..	..	..	..	..	..	..	5,490
2 Staff ..	1,836	2,244	2,316	2,686	2,758	2,830	1,854	2,854	2,854	2,854	26,086	
3 Feeding charges ..	1,752	2,232	3,108	4,354	2,944	4,944	4,944	4,944	4,944	4,944	41,100	
4 Office, etc. ..	620	620	620	620	620	620	620	620	620	620	6,200	
Total ..	9,698	6,096	6,044	7,650	8,322	8,394	8,418	8,418	8,418	8,418	78,876	

APPENDIX B.

Summary of Income.

	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Sixth year.	Seventh year.	Eighth year.	Ninth year.	Tenth year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Sale of milk—											
1 No of milking goats ..	80	100	150	200	200	200	200	200	200	200	
2 Value at Rs. 6 per goat ..	480	600	900	1,200	1,200	1,200	1,200	1,200	1,200	1,200	
Totals ..	560	700	1,050	1,400	1,400	1,400	1,400	1,400	1,400	1,400	10,380

(1)	Number. (2)	Value. (3)	Number. (4)	Value. (5)	Number. (6)	Value. (7)	Number. (8)	Value. (9)	Number. (10)	Value. (11)	Number. (12)	Value. (13)
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
II Sale of stock—												
1 Male kids at Rs. 4 each	40	160	50	200	75	300	100	400	100	400
2 Culled does and female kids at Rs. 7-8-0 each.	20	150	..	..	20	150	80	600	80	600
3 Better grade females at Rs. 15 each.	5	75	20	300	20	300
4 Stock at end of ten-year period.
Totals	310	..	200	..	525	..	1,300	..	1,300

	Number. (14)	Value. (15)	Number. (16)	Value. (17)	Number. (18)	Value. (19)	Number. (20)	Value. (21)	(22)
II Sale of stock—									
1 Male kids at Rs. 4 each	100	400	100	400	100	400	100	400	3,080
2 Culled does and female kids at Rs. 7-8-0 each.	80	600	80	600	80	600	80	600	3,900
3 Better grade females at Rs. 15 each.	20	300	20	300	20	300	20	300	1,875
							200 Feb 15	300	3,000
							8 Mar 25	200	200
4 Stock at end of ten-year period.	..	..	..	..	..	..	..	..	..
Totals ..	..	1,300	..	1,300	..	1,300	..	4,500	12,035

	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Total yearly income—										
1 Sale of milk ..	480	600	900	1,200	1,200	1,200	1,200	1,200	1,200	10,380
2 Sale of stock ..	..	..	810	200	525	1,300	1,300	1,300	1,300	12,035
Totals	480	910	1,100	1,725	2,500	2,500	2,500	2,500	5,700	22,415

Final summary—

1 Total yearly expenditure ..	9,698	5,096	6,044	7,650	8,322	8,394	8,418	8,418	8,418	8,418	78,876
2 Total yearly income ..	480	910	1,100	1,725	2,500	2,500	2,500	2,500	5,700	22,415	
3 Net yearly expenditure ..	9,218	4,186	4,944	5,925	5,822	5,894	5,918	5,918	5,918	2,718	56,461

LETTER FROM J. J. DEVALOIS, ESQ., B.Sc., PRINCIPAL, AGRICULTURAL INSTITUTE, KATPADI, TO THE SECRETARY TO GOVERNMENT, DEVELOPMENT DEPARTMENT, DATED THE 9TH APRIL 1934.

I have noted the remarks of the Director of Agriculture, Madras, and would like to give the following additional information bearing on the points he raises :—

1. *Enlargement of the scheme.*—No additional information called for.

2. *Grazing land available for the number of animals called for.*—Our intention is to ultimately have an area of perhaps 2 acres or more if necessary under various types of fodder crops such as guinea grass, napier grass, elephant grass, lucerne and agathi to supplement the grazing in the forest. Our plan also is to approach the Forest Department if the scheme is sanctioned to determine whether they will not enter into a special agreement with us for a certain area of land adjoining our farm. We have an area of 100 acres or so on the farm itself that is available for grazing in which we already have planted some and plan to plant many more thorn trees for goat-grazing purposes. We therefore feel that we will be able to manage suitable grazing and fodder for the herd as called for. May I say that the budget presented as regards costs of supplying roughage and concentrate feeds is an estimate only. Experience will have to determine whether our estimate is too low or in excess but at present I think it should cover our expenses.

3. *Staff.*—Originally we had drawn up the scheme calling for a writer but at the suggestion of the Deputy Director of Agriculture, Livestock, Hosur, this item was deleted. Since then the scheme has been considerably increased and I do think that in the present scheme a writer should be added perhaps from the beginning of the second year at a scale of Rs. 30—2—40.

4. *Records on graded animals kept outside the farm.*—I do not feel that we should undertake any additional animals at the farm outside of the pure-bred flocks. This is also in accordance with the suggestions of Imperial Council's expert advice. I added this not with the intention that such figures would be reliable but as a general guide as to what occurs when pure-bred males are mated with native females. I may say that we are already getting some cross-bred kids in the villages from the pure-bred Surti and Jumna Pari males we have at our farm now and we are finding that the village people appreciate the cross from the Jumna-Pari very much. It will now be interesting to see how these kids develop and how the village people take to them. This general information is what I had intended under this head. We might keep a few good cross-bred does of the first and succeeding generation as a check however confining our accurate records primarily to the pure-bred herds as suggested.

5. *Disposal of the goat's milk.*—The Women's Medical School and Hospital, Vellore, use about Rs. 300 worth of milk per month. I have already informally approached them with the suggestion that if this scheme goes into effect, we would appreciate their co-operation by helping us dispose of the milk in their hospital. No agreement has been made to date but I do think this is a possibility so that the anticipated difficulty may not be too great. The biggest obstacle will perhaps be the distance we will

have to transport the milk which is about 8 miles for which we will have to make special arrangements.

These remarks cover the subject under consideration, I believe.

ANNEXURE III.

Extract from the proceedings of the meeting of the Committee which considered the goat and sheep breeding schemes.

* * * * *

Goat Breeding.

The Committee considered that the same considerations must apply in the case of this scheme as in that of the Sheep Breeding Scheme as regards capital expenditure. Otherwise the scheme would be worthy of support if the work were confined to two breeds with flocks of 100 each, viz., Surti and Gujerati goats—both of all-India importance—which should be kept pure. The Council would then have research in goat breeding on similar lines dealing with the best two breeds of Eastern India and the best 2 of Western India and it was considered that a third scheme to deal with South Indian goats would be justifiable. They considered that the schemes submitted by the Bombay Government required modification but that it would be for the Advisory Board to decide whether they can finance this scheme in view of the fact that the local Government are not prepared to bear any part of the capital cost.

* * * * *

APPENDIX XXXV.

NOTE, DATED THE 14TH JULY 1934, ON SUBJECT No. 25, APPLICATION FROM THE UNITED PROVINCES POULTRY ASSOCIATION, LUCKNOW, FOR A GRANT OF Rs. 15,864 (Rs. 1,950 NON-RECURRING AND Rs. 13,914 RECURRING) SPREAD OVER THREE YEARS FOR A SCHEME TO INVESTIGATE THE PREPARATION OF EGGS FOR MARKETING AND OTHER METHODS OF DISPOSAL.

Attention is invited to the attached letter No. 436-I., dated the 5th June 1934 (Annexure I) from the Government of the United Provinces, forwarding a revised scheme on the subject mentioned above (Enclosure 1 to Annexure I).

2. As members of the Board are aware, the original scheme of the United Provinces Poultry Association (Annexure II) to develop egg and poultry marketing on a co-operative basis at a cost of Rs. 42,130 spread over five years and the report of the sub-committee of the Advisory Board (Enclosure 2 to Annexure I) on this scheme were considered by the Board at its meeting held on the 24th February 1934.

3. The Sub-Committee recommended that the United Provinces Poultry Association scheme should deal only with the investigation of the best methods of storage, preservation and disposal of poultry products in various ways, e.g., in the form of dry powder, and that the details of the accommodation and facilities which would be available and required for carrying on the work should be stated. It was also of the opinion that the post of Egg and Poultry Marketing Officer who should be appointed by and work directly under the Imperial Council of Agricultural Research should be eliminated from this scheme. The report of the Sub-Committee was adopted by the Advisory Board (Annexure III).

4. The United Provinces Poultry Association has revised the scheme in the light of the recommendations of the Sub-Committee. The revised scheme is estimated to cost Rs. 15,864 (Rs. 1,950 non-recurring and Rs. 13,914 recurring) spread over a period of 3 years, as against the estimated cost of Rs. 42,130 spread over 5 years for the original scheme. The Association has, however, not given the details of the accommodation and facilities which would be available and required for the work. An enquiry has been made from the United Provinces Government on the subject and their reply, when received, will be circulated to the Advisory Board.

5. The revised scheme is now for the consideration of the Advisory Board.

 ANNEXURE I.

COPY OF LETTER FROM THE SECRETARY TO GOVERNMENT, UNITED PROVINCES, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 436-I., DATED THE 5TH JUNE 1934.

SUBJECT:—*Scheme to investigate the preparation of eggs for marketing and other methods of disposal.*

In continuation of this Government's letter No. 24-I., dated January 11, 1934, I am directed to forward an application (with 150 spare copies) from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 15,864

(Rs. 1,950 non-recurring and Rs. 13,914 recurring spread over a period of three years) for the above mentioned scheme (Enclosure 1) and to state that it has been recommended by the United Provinces Agricultural Research Committee in its meeting held at Lucknow on April 27th, 1934. A copy of the Committee's resolution on the subject is enclosed.

2. I am to request that the scheme as now revised may please be placed before the Advisory Board of the Imperial Council at its next meeting.

COPY OF RESOLUTION NO. 3 PASSED AT THE 10TH MEETING OF THE UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE HELD AT THE COUNCIL HOUSE, LUCKNOW, ON APRIL 27, 1934, AT 9-30 A.M.

Resolution.

Agenda.

- | | |
|---|--|
| <p>3. Further consideration of the scheme of the United Provinces Poultry Association, Lucknow, for investigating the preparation of eggs for marketing and other methods of disposal as revised in accordance with the suggestions of the Advisory Board, for Rs. 15,864 (non-recurring Rs. 1,950 and recurring Rs. 13,914) spread over three years.</p> | <p>3. Resolved that the revised Scheme for Rs. 15,864 be recommended to the Imperial Council of Agricultural Research.</p> |
|---|--|

ENCLOSURE I TO ANNEXURE I.

APPLICATION FROM THE UNITED PROVINCES POULTRY ASSOCIATION, LUCKNOW, TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH FOR A GRANT OF Rs. 15,864 (Rs. 1,950 NON-RECURRING AND Rs. 13,914 RECURRING) FOR A SCHEME TO INVESTIGATE THE PREPARATION OF EGGS FOR MARKETING AND OTHER METHODS OF DISPOSAL, SPREAD OVER 3 YEARS.

Introduction.

At the last meeting of the Advisory Board of the Imperial Council of Agricultural Research, the United Provinces Poultry Association put up a scheme for the purposes of marketing and the handling of eggs and egg products. In the meeting of the Advisory Board of the Imperial Council of Agricultural Research it was felt that the actual problems of marketing on the large scale indicated were better done by a Central Organization for this purpose. They, therefore, were of the opinion that special reference to a Poultry Marketing officer should be omitted from the scheme and that the United Provinces Poultry Association should submit a scheme dealing with the actual handling of eggs preparatory to organized marketing. It is unnecessary in this application, therefore, to submit a long record of the work done by the United Provinces Poultry Association in the improvement of the indigenous egg in the United Provinces. It is sufficient to say that the first organized steps towards improving the Poultry industry in India was started in the United Provinces and that it has been going steadily forward for many years till at the present day there are a very large number of improved fowls and the quantity of improved eggs

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handled per annum by the United Provinces Poultry Association and individual members approximates to 1,800,000 per annum. These eggs are at the present day disposed of in a very rudimentary fashion and it is felt that information is badly required as regards the best methods of storage, preservation and packing of eggs and the preparation of fowls for market. It is also felt that investigation is required in the application of other methods of disposal as by dry powder or pulp form.

The experimental assistant suggested in the scheme mentioned below would in addition to experimental work of a nature recorded above also will seek to introduce these into practice among a limited number of societies so as to carry his work beyond the mere limits of the laboratory into active practical application thereby paying the way for the advantage of a marketing officer who could then apply the facts discovered on experiments into real life to the wider organization of marketing Indian eggs.

The scheme is one for three years in place of that proposed for 5 years in the original application. The marketing officer has been eliminated and the junior assistant has been replaced by a man of more experience. Necessary reductions have also been made in the contingent expenditure.

The chemical part of the work will continue to be done at the Harcourt Butler Technological Institute, Cawnpore.

ANNEXURE A.

NON-RECURRING.

Equipment—

	Rs.
Egg testing lamp : egg weighing scale, caponising set : grading and packing machine cups, mixers, etc., for dry eggs work	1,000
Cages for fattening fowls	50
Egg boxes : packing cases and cupboards for storing eggs, etc.	100

Office—

Table, almirah, safe, racks, etc.	200
Typewriter	400
Miscellaneous	200

Total non-recurring	1,950
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ANNEXURE B.

RECURRING.

Items.	First year.	Second year.	Third year.	Total 3 years.
	Rs.	Rs.	Rs.	Rs.
1. <i>Pay of establishment—</i>				
One Experimental Assistant (150—10—200).	1,800	1,920	2,040	5,760
One storekeeper and clerk (40—2—60)	480	504	528	1,512
One peon at Rs. 12 per month ..	144	144	144	432
2. <i>Contingencies—(Supplies and Services)</i>				
Stamps and stationery	100	100	100	300
Cost of books and periodicals ..	50	50	50	150
Travelling allowance	500	500	500	1,500
Demonstration exhibits	100	100	100	300
Rent of rooms for office and experimental purposes.	360	360	360	1,080
Supplies for experimental purposes ..	600	600	600	1,800
Contingencies	360	360	360	1,080
Total recurring ..	4,494	4,638	4,782	13,914
Total non-recurring ..				1,950
GRAND TOTAL ..				15,864

ENCLOSURE II TO ANNEXURE I.

Report of the Committee appointed to examine the scheme of the United Provinces Poultry Association to develop egg and poultry marketing on a co-operative basis (subject No. 4 of the agenda for the Advisory Board Meeting), held at New Delhi, on the 21st February, 1934.

The following were present :—

1. Colonel A. Olver.
2. Mr. E. J. Bruen.
3. Khan Bahadur Sheikh Niaz Muhammad.
4. Mr. P. J. Kerr.
5. Mr. T. F. Quirke.
6. Mr. B. K. Badami.
7. Mr. Nurul Islam.
8. Mr. A. E. Slater.
9. Mr. G. K. Devadhar.



As the Chairman was engaged in another meeting of the Fruit Committee, Colonel Olver took the chair.

The meeting lasted from 2-30 to 4-15 P.M.

The Committee considered that the scheme submitted by the United Provinces Poultry Association was costly for the work proposed and it also would not provide what is most required for the development of the industry, *viz.*, an expert Marketing Officer capable of advising and assisting provincial organizations and with facilities for developing the marketing of eggs and poultry products all over India, particularly in the big consuming centres. For this purpose they considered it necessary to have an egg marketing officer, working directly under the Imperial Council of Agricultural Research and recommended that the Animal Husbandry expert should put up a separate scheme for this work and that the United Provinces Poultry Association scheme should deal only with the investigation of the best methods of storage, preservation and disposal of poultry products in various ways, *e.g.*, in the form of dry powder, on the lines indicated on printed pages 3 and 4 of their scheme. It was stated that the local marketing of eggs and poultry products was already being dealt with in some provinces and States, but that a great deal of precise information was required on these matters. For this work the scheme would require modification and it was suggested that the Association should be requested to submit a modified scheme in which details should be given of the accommodation and facilities which would be available and required for carrying on such work.

ANNEXURE II.

NOTE, DATED THE 23RD JANUARY 1934, BY SECRETARY, ON SUBJECT No. 4.—APPLICATION FROM THE UNITED PROVINCES POULTRY ASSOCIATION, LUCKNOW, FOR A GRANT OF Rs. 42,130 (Rs. 2,500 NON-RECURRING AND Rs. 39,630 RECURRING) FOR A SCHEME TO DEVELOP EGG AND POULTRY MARKETING ON A CO-OPERATIVE BASIS SPREAD OVER FIVE YEARS.

Attention is invited to the attached letter from the Government of the United Provinces, No. 24-I, dated the 11th January 1934, forwarding a scheme for the development of egg and poultry marketing on a co-operative basis (Annexure). The Provincial Agricultural Research Committee which considered this scheme suggested some modifications, in the light of which the scheme has been recast.

2. The scheme is for the consideration of the Advisory Board.

ANNEXURE.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF UNITED PROVINCES, INDUSTRIES DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 24-I, DATED THE 11TH JANUARY 1934.

Scheme to develop egg and poultry marketing on a co-operative basis.

I am directed to forward an application (Enclosure I) from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 42,130 (Rs. 2,500 non-recurring and Rs. 39,630 recurring spread over a period

of five years) for the above-mentioned scheme as recast by the Provincial Director of Agriculture in accordance with the views expressed by the United Provinces Agricultural Research Committee at its meeting held at Lucknow on November 28, 1933. A copy of the Committee's resolution on the subject is enclosed (Enclosure II).

2. The Association is a body registered under the Societies Registration Act and is in receipt of a recurring grant from this Government for running a demonstration poultry farm. A copy of its last annual report* is enclosed, showing the nature of the work done by it. The Governor, acting with his Ministers, approves of the scheme as now recast. I am to request that it may be placed before the Advisory Board of the Imperial Council at its next meeting.

3. One hundred and fifty copies of the scheme are being sent to you under separate cover.

ENCLOSURE I.

Item.

APPLICATION FROM THE UNITED PROVINCES POULTRY ASSOCIATION, LUCKNOW, TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH FOR A GRANT OF Rs. 42,130 (Rs. 2,500 NON-RECURRING AND Rs. 39,630 RECURRING) FOR A SCHEME TO DEVELOP "EGG AND POULTRY MARKETING ON A CO-OPERATIVE BASIS" SPREAD OVER FIVE YEARS (AS RECAST BY THE DIRECTOR OF AGRICULTURE, UNITED PROVINCES, IN ACCORDANCE WITH RESOLUTION No. 5, DATED NOVEMBER 28, 1933, OF THE UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE).

Introduction.

Marketing of eggs and poultry has, of late, received the most careful attention of the whole world. There is a general impression that the quality and marketing of the produce leave much to be desired. The urgent necessity for effecting an all-round improvement is being seriously felt and efforts, on a co-operative basis, in this direction are already in progress in many countries. India is no exception to this condition. Trade in poultry and eggs in this country has been carried on for a long time past though in a very crude manner. Eggs have a great nutritional value for human beings as they are rich in proteins, fats, minerals and vitamins. They are a rich food for building up healthy children and are of considerable help to restore lost strength during convalescence. Eggs, besides many other uses, have a great importance from the industrial point of view also as they are used in different forms in the manufacture of ivory, paints and varnishes and are also utilized in book-binding, photography, tanning and the making of glue. Their last named service is perhaps not generally known in India. The demand for edible eggs of an improved quality is fast increasing in this country as its food value is being gradually better realized. A considerable portion of the year has to be idled away by the farmer because of no suitable occupation. This can be employed by means of poultry raising. The production of poultry and eggs, besides having several advantages of great economic importance to farmers, entails the investment of a very small capital. Its benefits are therefore accessible to the poorest class of peasant. But his

difficulties begin when he tries to improvise his own crude system of housing, feeding and breeding. He keeps poultry in ill-ventilated and tiny mud-houses and let the poor birds take care of themselves in regard to water, food and protection. Eggs are collected only when and if noticed and stored in *chatties*, jars, etc., where the embryo often begins to develop or the eggs go bad. The average hen in India finds her food and water in filthy places. As the quality of the egg depends very largely on the methods of production the result is a mass of sickly-looking and under-sized birds laying about five clutches of eggs (60 to 70) in a year, each weighing about $1\frac{1}{4}$ to $1\frac{1}{2}$ oz. only. Eggs produced by such birds cause great harm to the health of the country. But a very large part of the population of India has either to depend for its living on, or its income is substantially supplemented by this industry in spite of these unhygienic methods. The economic value of poultry farming began to be universally recognized by about the middle of the 19th century. The first fruits of this realization in India took the form of an All-India Poultry Club which was formed in 1910. The formation of this club and later that of the United Provinces Poultry Association through the efforts of Sir Harcourt Butler, the then Governor of the United Provinces and a life member of the club, and some other poultry enthusiasts, gave a great impetus to this industry in India. The economic value of poultry farming is being generally appreciated but what is now urgently called for is an organized policy of assistance in solving two vital problems, *viz.*, improved marketing and control of diseases. The latter of these is to receive attention. The present scheme is directed to dealing with the peculiarities of the former under Indian conditions.

METHODS OF MARKETING POULTRY AND EGGS IN INDIA WITH SPECIAL REFERENCE TO THE UNITED PROVINCES.

Marketing of eggs and poultry in these provinces is generally in the hands of egg contractors of whom the "Khatik" (professional egg and poultry dealer) is the most important. These Khatiks employ egg collectors who make house-to-house visits in order to collect the eggs and fowls from producers living in villages and towns. These egg collectors are generally given some commission per dozen eggs collected as a remuneration. In some cases they are also given daily wages on the quantity collected. Thus the produce has to pass two, three and sometimes even four intermediate agencies before reaching the actual consumer and consequently most of the profit is eaten up by these intermediaries. The necessity for eliminating or reducing as far as possible these intermediaries is obvious. Methods of packing and transporting the produce are unscientific and cause much avoidable loss. The total value per annum of poultry produce in a small country like Denmark comes to $4\frac{1}{2}$ crores of rupees and her export in eggs gives her an annual income of $2\frac{1}{2}$ crores of rupees. The value of hen egg alone on poultry farms in the United States of America in 1924 was approximately Rs. 1,93,02,92,410. This has been possible mainly by improved methods of production on farms and by the proper handling of eggs from the nest to the market. It is therefore evident how much more profitable this industry would become if the methods of marketing in this country as described in the preceding paragraphs could be replaced by those practised in Denmark and United States of America with necessary modifications to suit India's requirements. A

comparison between the income derived by the two kinds of methods of marketing, given below, will be of interest :—

Income by indigenous methods.

Average number of eggs, laid by a hen in a year.	Average weight of an egg.	Average price fetched by an egg.	Production value per hen per annum.
70	1½ oz.	4½ pies.	Rs. a. p. 1 10 3

Income by the improved methods in the Scheme.

150	2 oz.	9 pies.	7 0 8
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The object of the scheme and reasons governing the character of the request.—The improvement of poultry has received a large amount of attention in the United Provinces during the past 20 years and during the last 12 years impartial. The United Provinces Poultry Association is one of the best known organizations of the kind in the country. Mrs. Fawkes' work in establishing this association, in bringing the importance of this work before the public and in instituting courses of instructions are well known all over India and have had their most marked effect in the Province with which her work was most closely associated. In the last 12 years over Rs. 3½ lakhs has been spent on the improvement of the birds to which the Government of the United Provinces has contributed Rs. 3,09,041.

The outcome of this work has led to wide spread interest all over the Province and in others and there are at the present day in the United Provinces alone many hundreds of persons interested in some way in improved fowls whether as pure stock breeders or as working on the indigenous fowl with pure bred coeks.

The Poultry Association has now the nucleus in every district of future district associations and in 20 of these definite district organizations are established or are being established.

Those thus interested are estimated as handling over 12,000 fowls and giving rise approximately to 1,800,000 improved eggs per annum. In addition to the many individuals at present struggling on their own or in recently formed district units, there are in addition six Co-operative Societies concerned with egg and poultry production. There is thus ample material on which a Research and Marketing officer could operate with effect and wide scope for expansion as utilizing people who are willing to be directed and organized into some form in which they could more profitably dispose of their eggs than is very frequently the case.

The best methods of handling eggs and alternative methods of disposal, their relative costs, profits and possibilities require close study as also do the best methods of building up a marketing organization for those engaged in this industry.

The United Provinces thus provides an excellent field for investigation in all phases of the egg industry from the time they are laid till they reach in some form or other the ultimate consumer. Experience gained in these will be applicable anywhere in the country.

The importance of the development of the marketing side of an industry in conjunction with or in close connection with technical improvements in increasing production are now fully realized.

The Imperial Council of Agricultural Research have under close consideration the establishment of a Central Marketing Bureau for agricultural products. The United Provinces have expressed their willingness to provide a Deputy Director of Marketing to investigate and organize the marketing of agricultural produce in general and as working an association with the Central Body. They have also under close consideration the appointment of Fruit Expert and staff who will be employed to a considerable extent not merely in developing fruit production but also in studying and organizing its effective disposal as a special branch of agricultural marketing. This present proposal is in reality the application of the same principle to the Poultry Industry. The officer and his staff will, however, deal primarily with the disposal of the egg and with investigation on the feeding of fowls for market sale, leaving production and the expansion of the use of better birds with the United Provinces Poultry Association, as being work of a more provincial character. His work will be directed to work of all-India application. As the whole development of Poultry within the Province has rested with the Poultry Association, it is proposed in this scheme that he should work as part of that organization; but it is intended that in the technical side of his work he will be guided in his efforts by the provincially appointed Marketing officer who will be of Provincial Class I Status. In short that this officer and his staff will form one of the branches of marketing enterprise, differing only in the fact that his work as a species of research will have a much wider significance.

The United Provinces in view of their coming developments in agricultural produce marketing in other directions and in view of the more general applicability of the results of the work of this officer and his staff, if appointed, are not in a position to come to the aid of the Poultry Association, though they are fully satisfied that such help is necessary, if the full advantage of the last decade and more of technical improvement is to be gained by the egg producer wherever such technical advance has been fully established.

The principal duties of this officer will be :—

- (1) to investigate and improve on present methods of collection, storage, preservation, packing of eggs and of preparing fowls for markets,
- (2) to study on a small scale the application of other methods of disposal as by dry powder or in pulp form,
- (3) to investigate the demands of different markets,
- (4) to study different methods of organizing producers and the best methods of transport and disposal of the produce of organized units,

- (5) to study the extent and scope of profit derivable by different types of society production, production and sale, collecting and marketing.

It is normal in the case of an application for a grant to state what is being provided by the applicant. Though this may be a *sine qua non* in respect of a grant as made to a Government, in the case of a private association it is not possible for them to offer much of substantial character. It may, however, be pointed out that the association as evidenced earlier in this note has contributed very substantially to the advancement of the poultry industry both in the Province and generally in India—men from all parts of the country have received training at its hands and settings of eggs have been distributed to every province. Further that as the outcome of its efforts it has been able to offer a state of improved poultry development in which research of this kind may have an ample field of investigation, a condition which could not have existed but for the efforts of the association and its office bearers. It thus places its application for help in seeking a solution for an important problem of the industry on which the ultimate success or failure of any such enterprise as that which they represent must depend with every expectation that the Imperial Council of Agricultural Research will recognize the claims for help of this kind which the Poultry industry deserves as the poor man's industry and as providing another avenue of increasing rural wealth.

CONCLUSION.

Work on almost the same lines, as proposed, is being done in England, Ireland, and United States of America. This method, with the modifications referred to in this scheme, may be tried which it is hoped, will lead to an improvement and subsequently create conditions favourable for the development of an export trade in eggs, specially by the availability of the quality and quantity of eggs necessary for export purposes and by the regularity in supply.

COST OF THE SCHEME.

The estimated cost of the scheme is Rs. 42,130 spread over a period of five years the details of which will be found in the Annexures.

ANNEXURE A.

Non-recurring.

Equipment—

	Rs.
Egg testing lamp ; egg weighing scale ; caponising set ; grading and packing machine, cups, mixers, etc., for dry egg work	1,000
Cages for fattening fowls	50
Egg boxes ; packing cases and cupboards for storing eggs, etc.	100

Office—

					Rs.
Table, almirahs, safe, racks, etc.	..	..	..	..	250
Type-writer	..	..	..	..	400
Lantern and slides	..	..	..	..	500
Miscellaneous	..	..	..	..	200

Total non-recurring .. 2,500

ANNEXURE B.

Recurring.

Items.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total five years.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
(1) Pay of officers—						
One egg and poultry marketing officer (Rs. 200—15—380).	2,400	2,580	2,760	2,940	3,120	13,800
(2) Pay of establishment—						
(i) One Assistant (Rs. 80—5—150).	960	1,020	1,080	1,140	1,200	5,400
(ii) One storekeeper and clerk (Rs. 40—2—60).	480	504	528	552	576	2,640
(iii) Two peons at Rs. 12 per mensem each.	288	288	288	288	288	1,440
(3) Stamps and stationery ..	300	300	300	300	300	1,500
(4) Cost of books and periodicals	50	50	50	50	50	250
(5) Travelling allowance ..	1,200	1,200	1,200	1,200	1,200	6,000
(6) Demonstration exhibits ..	100	100	100	100	100	300
(7) Rent of rooms for office and experimental purposes.	360	360	360	360	360	1,800
(8) Supplies for experimental purposes.	900	900	900	900	900	4,500
(9) Contingencies ..	360	360	360	360	360	1,800
Total recurring ..	7,398	7,662	7,926	8,190	8,454	39,630
Total non-recurring ..	..	..	..	..	..	2,500
GRAND TOTAL ..	..	..	..	..	..	42,130

ENCLOSURE II.

COPY OF RESOLUTION No. 5 PASSED AT THE 9TH MEETING OF THE UNITED PROVINCES AGRICULTURAL RESEARCH COMMITTEE HELD AT THE COUNCIL HOUSE, LUCKNOW, ON NOVEMBER 28, 1933.

Agenda.	Resolution.
<p>5. Consideration of an application from the United Provinces Poultry Association, Lucknow, to the Imperial Council of Agricultural Research for a grant of Rs. 42,050 (Rs. 2,000 non-recurring and Rs. 40,050 recurring) for a scheme to develop "Egg and Poultry marketing on a co-operative basis" spread over five years.</p>	<p>5. Resolved that the Director of Agriculture be asked to recast the scheme in the light of discussion and that the scheme so amended be recommended to the Imperial Council of Agricultural Research.</p>

Note of dissent.

I am afraid I am unable to agree with the views expressed in the enclosed report. I may here state that I am of the same opinion in this connection as that I expressed in the sub-committee meeting. The scheme in question is definitely one for an All-India work. I cannot find anything in the scheme to indicate that there is no provision for an expert Marketing Officer, capable of advising and assisting provincial organizations. Regarding the second portion of the third sentence I may only refer the Board to pages 2 and 3 of the scheme. The author, however, in drawing up this scheme felt that the work should be carried on, on a small scale in the beginning in the United Provinces, where, there is unanimity of opinion, that there is the biggest field for this work, and later extended to other places. This should be done after the public are convinced of the utility of the work. Even during the course of the work proposed in the scheme there can be no objection to the services of the officer being utilised by other provinces, and I am unable to find anywhere in the scheme any word which indicates any restriction on the activities of the officer to the United Provinces only.

(Sd.) NURUL ISLAM.

ANNEXURE III.

Extract from the Proceedings of the Meeting of the Advisory Board held on the 20th February 1934.

11. Application from the United Provinces Poultry Association for a grant of Rs. 42,130 (Rs. 2,500 non-recurring and Rs. 39,630 recurring) for a scheme to develop egg and poultry marketing on a co-operative basis. (Subject No. 4 of the Agenda.)

It was decided to refer the scheme for consideration to the Poultry Committee to which the name of Mr. Devadhar was added.

Extract from the Proceedings of the meeting of the Advisory Board held on the 24th February 1934.

14. *Application from the United Provinces Poultry Association for a grant of Rs. 42,130 (Rs. 2,500 non-recurring and Rs. 39,630 recurring) for a scheme to develop egg and poultry marketing on a co-operative basis. (Subject No. 4 on the agenda.)*

Colonel Olver introduced the scheme and the report of the Committee which had examined it together with the note of dissent by Mr. Nurul Islam. Colonel Olver explained that the Committee felt that the scheme was costly and would not provide what was most required for the development of the industry, *viz.* :— an expert marketing officer capable of advising and assisting provincial organisations and facilities for developing the marketing of eggs and poultry products all over India, particularly in the big consuming centres. The Committee felt that the scheme as submitted by the United Provinces Poultry Association would not provide for this important matter. They recommended that for the all-India work an egg marketing officer should work under the Imperial Council of Agricultural Research and that the Animal Husbandry Expert should put up a separate scheme for this work. As regards the rest of the work proposed the Committee were of the opinion that a great deal of precise information was required but to carry out the necessary investigations, modification of the scheme put up by the United Provinces Poultry Association would be necessary. The Committee therefore suggested that the Association should be requested to submit a modified scheme in which details should be given of the accommodation and facilities which would be available and required for carrying on such work. He then moved the adoption of the majority report. The motion was seconded by Mr. Quirke. Mr. Nurul Islam speaking on his note of dissent said that the point regarding the costliness of the scheme was that the Committee considered that provision for Travelling Allowance would be insufficient. He did not attach any importance to this inasmuch as the provision could be increased. As regards the appointment of an egg marketing officer on an all-India basis he was of the opinion that work could be started only where there were material and facilities available. In the United Provinces all such material and facilities were available and he did not think the Committee was justified in asking the Imperial Council of Agricultural Research to spend more money on the appointment of a highly paid egg marketing officer. He added that the services of the staff proposed in the scheme could be utilised by other provinces if need be. He added that he had no objection to the scheme as submitted being directed by the Imperial Council of Agricultural Research and went on to say that marketing was the principal idea of the present scheme and that without it not much would be left of it. In the end he asked the Board to pass the scheme as prepared by the United Provinces Poultry Association. Mr. Quirke in supporting Colonel Olver's motion said that in his opinion the marketing of egg should be directed by the Council, while the other matters connected with the poultry production referred to in the Committee's report should be dealt with by the United Provinces Poultry Association. Mr. Allan said that while he supported the idea of appointing an all India officer for marketing purposes, he was of the opinion that the present scheme would help the agriculturists and favoured it to be sanctioned. Dr. Burns referred to the attempts already made to develop poultry industry and supported the scheme

as submitted by the United Provinces Poultry Association. Mr. Devadhar said that the scheme was a valuable aid to rural reconstruction. He was interested in it from the co-operative point of view as it was mentioned in the scheme that there were six co-operative societies concerned with egg and poultry production. It was not clear however whether these societies were registered under the Co-operative Societies Act. He was informed that they were not registered. He therefore favoured the recommendations made by the Committee. In this connection Dr. Nehru referred to the report of Mr. T. Murari, Superintendent, Livestock Research Station, Hosur, Madras, who was deputed by the Imperial Council of Agricultural Research to attend the Fifth World Poultry Congress in September 1933, in which he had suggested that the lesson to be learnt from the Congress was that it was time that India had a full time poultry officer for studying the available breeds and evolving useful types required for Indian conditions. He said that rabbits and pigeons should not be neglected. Dr. Nehru was of the view that it was necessary to accelerate the growth of birds on modern lines. In the end he supported the appointment of a marketing and research officer on an all-India basis. Mr. Carpenter said that he understood that the Council intended to appoint shortly a marketing expert for the development of agricultural produce in India and that for this purpose the Government of India were likely to make a grant of one lakh of rupees per annum for a period of three years. In his opinion the Marketing officer and the marketing branch of the Council will consider the question of marketing of eggs also, and it would not be right for the Board at this stage to definitely commit themselves as to how the marketing of eggs should be dealt with. He, however, supported the Committee's report. After Mr. Nurul Islam had replied the Committee's report was adopted.

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SUPPLEMENTARY NOTE, DATED THE 1ST SEPTEMBER 1934, ON SUBJECT No. 25: APPLICATION FROM THE UNITED PROVINCES POULTRY ASSOCIATION, LUCKNOW, FOR A GRANT OF RS. 15,864 (RS. 1,950 NON-RECURRING AND RS. 13,914 RECURRING) SPREAD OVER THREE YEARS FOR A SCHEME TO INVESTIGATE THE PREPARATION OF EGGS FOR MARKETING AND OTHER METHODS OF DISPOSAL.

In continuation of paragraph 4 of the note already circulated on the subject mentioned above, the reply from the Government of the United Provinces regarding the details of the accommodation and facilities which would be available and are required in connection with the scheme, has since been received and is circulated to Advisory Board.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF THE UNITED PROVINCES, INDUSTRIES DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 2190-XVIII-652, DATED THE 22ND AUGUST 1934.

SUBJECT :—*Application from the United Provinces Poultry Association, Lucknow, for a grant of Rs. 15,684 (Rs. 1,950 non-recurring and Rs. 13,914 recurring) spread over 3 years for a scheme to investigate the preparation of eggs for marketing and other methods of disposal.*

With reference to your letter No. F. 7-(4)|34|Vet., dated July 18, 1934, on the above subject, I am directed to enclose a copy of letter

No. E.S.]1069, dated the 6th August 1934, from the Secretary, United Provinces Poultry Association, Lucknow, to the Director, Civil Veterinary Department, United Provinces, Lucknow, furnishing the details of accommodation and facilities which would be available and are required in connection with the scheme to investigate the preparation of eggs for marketing and other methods of disposal.

COPY OF LETTER FROM THE SECRETARY, UNITED PROVINCES, POULTRY ASSOCIATION, LUCKNOW, TO THE DIRECTOR, CIVIL VETERINARY DEPARTMENT, UNITED PROVINCES, LUCKNOW, No. E.S.]1069, DATED THE 6TH AUGUST 1934.

With reference to your Memorandum No. 1946|VIII-10-B-13, dated 1st August 1934, I have the honour to state that the scheme originally submitted was for a practical marketing research for the best method of marketing poultry, eggs-in-shell, feathers, manure, etc., whereas the preparing of egg powder and egg-pulp to receive partial consideration, specially as the demand for these commodities has declined to a considerable extent.

The scheme that has been submitted now in the modified form requires work both in the laboratory as well as the practical side of it. Since the Association has not the facilities for undertaking laboratory side of the work, we will have to concentrate mostly on the practical work only.

A broad outline of the programme of the work drawn up by the author of the scheme is as under :—

- (a) A study of the present indigenous organisation for the preparation of eggs for market with a view to improving the same. This will be done by means of visits to places where work is being done.
- (b) A study, in detail, of the organisation of collection of eggs within the provinces so as to devise best methods of collecting the improved eggs.

This will be done by working amongst the present societies and local associations operating under the direction and guidance of the Association and by organising new ones for the purpose.

- (c) A study of the methods of testing, grading, packing and transporting eggs in order to devise an improved system for these which may lead to a decrease in costs and increase in returns. This will be tackled in the same manner as described in paragraph B.
- (d) A study of the work done by the Association in regard to storage, preservation and by the Industrial Chemist to the United Provinces Government on dry egg work with a view to improving the former and exploring the possibilities of turning the latter into a profitable business.

This will be carried on by the Experimental Assistant at his Headquarters.

The problems described in paragraph A to D will be taken up in the order in which they are named.

The Commitments of the Association under the scheme are as follows :—

- (1) The Association will be pleased to depute the Author of the scheme, Mr. Nur-ul-Islam, Assistant to Secretary and Demonstrator to work on the staff of the scheme, but his pay will be met from the scheme.
- (2) The Association will be pleased to spare two rooms for office and store in its office building.
- (3) The Association will give all facilities it can possibly give in procuring materials such as eggs, fowls, etc., that may be required for the work.

APPENDIX XXXVI.

NOTE DATED THE 30TH JULY 1934, ON SUBJECT NO. 26 : APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF RS. 37,580 (RS. 2,630, NON-RECURRING AND RS. 34,950, RECURRING) SPREAD OVER A PERIOD OF TEN YEARS FOR SHEEP BREEDING RESEARCH IN MADRAS.

Attention is invited to the extract from the proceedings (Enclosure I) of the meeting of the Advisory Board held on the 20th February 1934 in which the Board desired that the above mentioned scheme should be referred to the Committee which considered the Bombay Goat and Sheep Breeding Schemes and the Hyderabad Sheep Breeding Scheme. This *ad hoc* Committee consisted of the Animal Husbandry Expert to the Council and the Directors of Agriculture, Madras and Bombay, Directors of Veterinary Services, Punjab and Hyderabad and the Director, Imperial Institute of Veterinary Research, and Khan Sahib N. K. Vacha, Superintendent, Civil Veterinary Department, Baluchistan and Mr. H. G. Baluch, Professor of Dairying, Agriculture College, Poona. With the exception of the last two, all the other members of the Committee are likely to be present at the meeting of the Advisory Board. The Madras Sheep Breeding Scheme has therefore been referred to the Standing Cattle Breeding Committee of the Council to which such of the members of the *ad hoc* Committee who will be present at the meeting of the Advisory Board will be co-opted. The report of the Committee on this scheme will be circulated to the members of the Board in due course.

2. Meanwhile, the papers relating to the scheme (Enclosure II) are circulated to members of the Board.

ENCLOSURE I.

Extract from the proceedings of the meeting of the Advisory Board held on the 20th February 1934.

APPLICATION FROM THE GOVERNMENT OF MADRAS, FOR A GRANT OF RS. 37,580 (RS. 2,630, NON-RECURRING AND RS. 34,950 RECURRING) SPREAD OVER A PERIOD OF TEN YEARS FOR SHEEP BREEDING RESEARCH IN MADRAS (SUBJECT NO. 26 OF THE AGENDA).

9. Rao Bahadur Ananda Rao introduced the scheme. Mr. Kerr said that one sheep breeding research scheme was already working and enquired whether there would be any overlapping. Colonel Olver referred to the provision in the scheme on account of the cost of 40 Bellary ewes and enquired whether that was the total number proposed to be purchased or whether it was in addition to the stock already available. To this Mr. Ananda Rao replied that it was in addition to 61 ewes already there. Colonel Olver then said that this number was sufficient for purposes of the scheme as the Sheep Breeding Schemes Committee which had considered the previous scheme was of the opinion that 100 was the minimum number for the purpose. He added that in his opinion we should not wait for the results of the other scheme and that this scheme should be approved in addition to the other scheme already working. He thought that the type of sheep in Madras was different from the other types. The

object of the scheme was two-fold, *viz.*, the improvement of local breeds by selection and by cross breeding with Bikanir Breed. In the end he suggested that before the scheme was approved by the Board it should be considered by the Sheep Breeding Schemes Committee on the occasion of the next Advisory Board Meeting. The suggestion was approved by the Board.

* * * * *

ENCLOSURE II.

NOTE DATED THE 29TH JANUARY 1934, ON SUBJECT NO. 26 : APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF Rs. 37,580 (Rs. 2,630, NON-RECURRING AND Rs. 34,950, RECURRING) SPREAD OVER A PERIOD OF TEN YEARS FOR SHEEP BREEDING RESEARCH IN MADRAS.

Attention is invited to the attached letter from the Government of Madras, No. 2669-III|33, dated the 22nd January 1934 (Annexure), forwarding a scheme on sheep breeding at a cost of Rs. 37,580 (Rs. 2,630 non-recurring and Rs. 34,950 recurring) spread over a period of ten years. It has been estimated that a sum of Rs. 8,509 will be recovered by sale of stock during the ten years.

The scheme is now for the consideration of the Advisory Board.

ANNEXURE.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 2669-III|33, DATED THE 22ND JANUARY 1934.

Revised Scheme on sheep breeding.

In continuation of my letter No. 2669-III|33-2, dated 14th August 1933, I am directed to enclose a scheme on sheep breeding (Enclosure) revised in the light of the recommendations of the Sheep Breeding Committee of the Imperial Council of Agricultural Research.

2. The Provincial Research Committee recommends the scheme.
3. 150 printed copies of the scheme will be forwarded in due course.

ENCLOSURE.

Revised Scheme on sheep breedings.

In the Madras Presidency we find the woolly variety of sheep in the districts which have a good cold weather such as the North Salem, Coimbatore and Bellary. Most of these sheep are black and white in colour. At Hosur a flock of Bellary sheep have been maintained with the object of evolving a white breed of sheep. All the ewes we have are white with black on their faces and ears, when these are mated together, we get a fair number of black lambs and very few white lambs besides the white black face. The white lambs are delicate in constitution and cannot stand up to conditions as well as the white black face ones. Through very careful attention some white lambs have been reared but they are

smaller, give a less wool yield and are not so robust in health. By mating white and white together, most of the progeny have died and personally I do not think we can raise a white flock without importing a new white ram. Clipping is carried out twice a year, in February and August and the wool yield has risen for the whole flock up to 2 lb. 12 oz. The ewes clip about 1—12 oz. to 2 lb. 4 oz. on the average in the year. The weight of a good white black face ram is about 120 to 125 lb. At Hosur we have a flock of about 60 ewes. If we can raise a white flock of sheep which will give us about 4 to 5 lb. of wool per sheep, it will be of great help to the ryot. It is fairly hot on the plains; therefore we cannot expect to rear a flock of heavy wool bearing sheep.

It is proposed to use rams of the Bikanir breed in order to find out the effect of such cross-breeding with the Bellary breed and also to do careful selection in the same breed.

Some country ewes will be sold each year on account of age and irregular breeding.

The price of rams appears rather low but it will take time to convince the ryots to purchase them, therefore the price of ordinary country rams has been placed on these cross-bred rams for purposes of income.

The object—

- (1) To breed a type of white wool sheep as far as possible.
- (2) To produce a sheep which will give more and better wool and also a better carcase and one which will respond to feeding and fatten easily and be suitable for the climate of Southern India.
- (3) To ascertain if sheep can stand two lambing periods in one year if well fed without suffering in constitution and physique.
- (4) Best time for castration.
- (5) Teaching of better methods of shearing and wool classing.
- (6) To investigate diseases of sheep in collaboration with the Director of Veterinary Services.

It has been found that shearing twice a year, once in February and the other in August, we get a bigger wool yield in the year.

Buildings and lands.—There are enough buildings and pasture at Hosur where the experiment is to be conducted.

Stocking the farm.—I suggest that 200 ewes of Bellary sheep be accepted as the foundation stock to be spread over a period of ten years for the two items of work proposed.

ESTIMATE FOR THE SCHEME.

SELECTED BELLARY FLOCK.

Capital expenditure.

	Rs.	Rs.
Cost of 40 Bellary ewes at Rs. 10	400	
Railway freight	70	
Cost of one shearing machine and extra blades ..	120	
	<hr/>	
Total ..		590

Recurring expenditure.

	Rs.	Rs.
Labour—		
One shepherd at Rs. 12	144	
Three boys at Rs. 8	288	
Extra for shearing and dipping	24	
One night watchman at Rs. 12	144	
	<hr/>	
	600	

Maintenance, etc.

Feeding charges concentrates	320	
Veterinary charges	30	
Cost of dip, etc.	20	
Repairs to feeding troughs, shearing machines, etc.	30	
	<hr/>	
	400	
	<hr/>	
Total—First year ..		1,000

Receipts.

First year—		
By sale of wool at As. 5 per lb.	64	
By sale of 15 rams at Rs. 6	90	
By sale of 5 barren ewes at Rs. 6	30	
	<hr/>	
		184
Second year—		
By sale of wool	72	
By sale of 30 ewes at Rs. 6	180	
By sale of 30 rams at Rs. 6	180	
	<hr/>	
		432

SELECTED BELLARY FLOCK—*contd.**Receipts—contd.*

Third year—

By sale of wool	80
By sale of 30 ewes at Rs. 6	180
By sale of 30 rams at Rs. 6	180

 440

Fourth year—

By sale of wool	80
By sale of 35 ewes at Rs. 6	210
By sale of 35 rams at Rs. 6	210

 500

Fifth year—

By sale of wool	80
By sale of 38 ewes at Rs. 6	228
By sale of 38 ewes at Rs. 6	228

 536

GRADED BIKANIR BELLARY SHEEP.

Capital Expenditure.

Purchase of Livestock.

First year—

	Rs.	Rs.
Hundred Bellary ewes at Rs. 10	1,000	
Railway freight, etc	140	
Cost of three Bikanir rams for Hosur	180	
	<hr/>	1,320

Third year—

Cost of three Bikanir rams	180	180
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Fifth year—

Cost of three Bikanir rams	180	180
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Seventh year—

Cost of three Bikanir rams	180	180
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Ninth year—

Cost of three Bikanir rams	180	180
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 Total .. 2,040

Recurring expenditure—

Maintenance, etc.—

Recurring expenses.

	I	II	III	IV	V	VI	VII	VIII	IX	X
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Staff and labour—										
One farm manager, Rs. 85—5—120 (average pay, Rs. 107-5/9.)	1,291	1,291	1,291	1,291	1,291	1,291	1,291	1,291	1,291	1,291
Leave contribution at $12\frac{1}{2}$ per cent.	161	161	161	161	161	161	161	161	161	161
Pensionary contribution at 8-1/6 per cent. of the maximum pay, i.e., Rs. 120.	118	118	118	118	118	118	118	118	118	118
Oneshepherd at Rs. 12 for first two years and at Rs. 13 for the succeed- ing years.	144	144	156	156	156	156	156	156	156	156
Three boys at Rs. 8 each	288	288	288	288	288	288	288	288	288	288
Extra for shearing and dipping, etc...	28	28	24	26	28	28	24	26	26	26
Maintenance—										
Feeding charges—Concentrates ..	320	430	430	500	400	320	320	320	320	320
Veterinary charges, cost of dip, etc.	50	50	60	60	50	50	50	50	50	50
Repairs to troughs, shearing machine, etc.	30	30	40	40	30	30	30	30	30	30
	2,430	2,540	2,618	2,640	2,522	2,442	2,438	2,440	2,440	2,440

Receipts.

	Rs.	Rs.
First year—		
Sale of 160 lbs. wool at 4 annas ..	40	
Sale of 5 ewes at Rs. 5 each ..	25	
		65
Second year—		
Sale of 200 lb. wool ..	50	
Sale of 5 ewes at Rs. 5 each ..	25	
Sale of 37 ram lambs at Rs. 5 each ..	185	
		260
Third year—		
Sale of 250 lbs. wool ..	62 $\frac{1}{2}$	
Sale of 6 ewes at Rs. 5 each ..	30	
Sale of 35 ram lambs at Rs. 5 each ..	175	
		267 $\frac{1}{2}$
Fourth year—		
Sale of 280 lb. wool ..	70	
Sale of 40 ewes at Rs. 5 each ..	200	
Sale of 44 ram lambs at Rs. 5 each ..	220	
		490

Receipts—contd.

Fifth year—

Sale of 240 lbs. wool	60	
Sale of 30 ewes at Rs. 5 each	150	
Sale of 45 ram lambs at Rs. 5 each	225	
		435

Sixth year—

Sale of 220 lbs. wool	55	
Sale of 38 ewes at Rs. 5 each	190	
Sale of 38 ram lambs at Rs. 5 each	190	
		435

Seventh year—

Sale of 260 lbs. wool	65	
Sale of 38 ewes at Rs. 5 each	190	
Sale of 38 ram lambs at Rs. 5 each	190	
		445

Eighth, ninth and tenth years average income each year	440
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SUMMARY.

Selected Bellary Flock.

	Rs.	Rs.
Capital expenditure	—	590
Recurring expenditure—		
First year	1,000	
For ten years	—	10,000
Estimate of income—		
First year	184	
Second year	432	
Third year	440	
Fourth year	500	
Fifth year	536	
Average for five years (sixth to tenth years) at Rs. 540	2,700	
		4,792

Graded Bikanir Flock.

Capital expenditure—

First year	1,320
Third year	180
Fifth year	180
Seventh year	180
Ninth year	180

Total ..	2,040
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Recurring expenditure—

First year	2,430
Second year	2,540
Third year	2,618
Fourth year	2,640
Fifth year ..	..	..	2,522
Sixth year ..	..	..	2,442
Seventh year	2,438
Eighth year	2,440
Ninth year	2,440
Tenth year	2,440

Total ..	24,950
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Estimate of income—

First year	65
Second year	260
Third year	267
Fourth year	490
Fifth year	..	..	435
Sixth year ..	..	..	435
Seventh year	445
Eighth year	440
Ninth year	440
Tenth year	440

Total ..	3,717
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Grand total—Expenditure for ten years—

Capital expenditure	2,630
Recurring expenditure	34,950
Total ..			37,580
Receipts ..	..	..	8,509

APPENDIX XXXVII.

NOTE, DATED THE 2ND AUGUST 1934, ON SUBJECT NO. 27 : REVISED SCHEME FOR RESEARCH ON SHEEP BREEDING IN HYDERABAD STATE.

Attention is invited to the note, dated the 25th July 1933, with which an application from H. E. H. the Nizam's Government for a grant for a Sheep Breeding Scheme was circulated to the Advisory Board at its meeting held in August 1933 (Enclosure I). The Scheme was first referred to the committee constituted to consider the Bombay Sheep Breeding Scheme, but it was not proceeded with at the instance of the Director of Agriculture, Hyderabad State, who informed the Committee that a revised scheme would be submitted for consideration. On the report of the Committee, the Advisory Board agreed to the Scheme being withdrawn.

2. The Hyderabad Government have now submitted a revised scheme (Enclosure II). This involves, so far as the Council is concerned, a non-recurring expenditure of Rs. 9,960 and recurring expenditure of Rs. 68,000, i.e., total expenditure of Rs. 77,960 spread over a period of ten years. The scheme is expected to yield an income of about Rs. 1,000 per annum, which would be credited to the Council, if so desired.

3. It may be noted that supplementary information has been asked for from the Hyderabad Government in regard to the arrangements to be made for the direction and control of the sheep breeding work if extended as proposed (Enclosure III). The information, when received, will be placed before the Board separately.

4. The Vice-Chairman to the Council considers that the present scheme should be examined in the first instance by the Cattle Breeding Committee, which will meet in conjunction with the next meeting of the Advisory Board. The report of the Committee will be submitted to the Advisory Board for consideration.

ENCLOSURE I.

Note, dated the 25th July 1933, by Secretary on Subject No. 35 : Application from the Hyderabad Government for a Grant of Rs. 39,310 spread over a period of 5 years for Research on Sheep Breeding.

Attention is invited to the attached application from H. E. H. the Nizam's Government (Appendix) for a non-recurring grant of Rs. 10,880 and a recurring grant of Rs. 28,430 spread over a period of five years or a total grant of Rs. 39,310, for research on sheep breeding. The Hyderabad Government have undertaken to provide land and building valued at Rs. 7,100.

2. The scheme will be referred in the first instance to the committee constituted to consider the Bombay Sheep Breeding Scheme (Subject No. 33).

The committee will meet at Simla on Monday, the 7th August 1933, at 2-30 P.M. and its report will be submitted to the Advisory Board for consideration.

APPENDIX.

Hyderabad Sheep Breeding Scheme.

The Royal Commission on Agriculture in India, while recording their opinion on the need and prospects of improvement of sheep breeding industry in India, said, "The expressions of opinion we heard on the prospects of sheep breeding were sanguine; more sanguine indeed for the immediate future than the existing position and the difficulties to be encountered seem to us to warrant. We recognise the great scope for improvement, and we believe that, in spite of obvious difficulties, great improvements are possible; but the prospects of the *get-rich-quick* adventurer are no better in the twentieth than they were in the nineteenth century."

Regarding the method to be followed for breeding the Commission said, "We recommend that the main energies of live-stock experts now resuming the work should be concentrated on a study of the best indigenous types and that the building up of a ewe flock with definite characteristics should be aimed at, before modification of these characteristics by crossing is decided upon." The matter was discussed at the last meeting of the Animal Husbandry Wing of the Board of Agriculture, held in February 1933, at Delhi, and they, while welcoming the sustained experiments in crossing of Merinos with specially graded indigenous breeds, were of the opinion, that improvement can best be accomplished by the establishment in each province and State of selected flock of the better indigenous breeds with the object of providing a nucleus of sufficient purity to render possible the resuscitation of each breed. The need and possibilities of improvement are already well-recognised, and there is therefore no necessity of stressing upon it any more. Experiments in crossing the indigenous breeds with foreign breeds are already in progress on some farms, and the results seem to be promising. But, much more work is necessary. And, both the Royal Commission and the Board of Agriculture are of the opinion that the best method would be to start with selection in the indigenous breeds

According to the report of the Royal Commission the total number of sheep in British India is 23 millions of which 11 millions are in the Madras Presidency and 4 millions in the Punjab. All other provinces have smaller numbers. The sheep population in the Hyderabad State is about 6 millions. Therefore, Hyderabad State is the next most important province after Madras in the importance of sheep breeding industry. A fairly large quantity of wool is produced, most of which is used locally, while the rest is exported to the woollen mills in Bangalore and to northern India. But, the amount of wool produced per sheep is very small, *i.e.*, only about a pound per head. The quality of wool is also very poor, though it is considered to be better than that produced by the Madras and Mysore sheep.

It is common, however, to find individual sheep of which the wool is much above the average. It is, therefore, desirable that an attempt should be made to increase the quantity of wool and to improve its quality as far as possible. A proposal to start a sheep breeding farm in Hyderabad for these purposes was worked out some two or three years back and sanctioned by the Government of His Exalted Highness, but has since been held up for want of funds. The idea is to secure the best animals procurable and then to select for quantity and quality of wool. The existing sheep in Hyderabad are white or black or of every shade of brown between. The dominant colour and the one which is more popular with the breeders in the country and for manufacture of blankets in villages is black, while white is considered more valuable from an export point of view.

It is, therefore, proposed to start with the following herds:—

- (1) Two flocks of 25 ewes and one ram each of the black kind, and
- (2) Two flocks of 25 ewes and one ram each of the white kind.

Two separate flocks of each kind are proposed, so that it may be possible to change the blood in future to avoid in-breeding.

Most of the sheep in the Hyderabad State are in its south-eastern part, called Pelingana, which adjoins the western and southern districts of the Madras Presidency and the southern districts of the Bombay Presidency. The sheep breeding farm is

proposed to be located in the Telingana. Conditions being similar to a great extent, the results achieved at this farm will be of value to the neighbouring provinces also. There is one other advantage in Hyderabad. The State has a Textile Institute in which there is a small wool spinning and weaving plant. All work in connection with testing of wool can be done at this institute, without incurring any expenditure on extra equipment. The services of the Civil Veterinary Department of the State are, of course, available in medical matters. The State is spending and has to spend a lot of money on development of its agricultural department, apart from the difficulties on account of the unfortunate financial stringency. It is, therefore, unable to finance this scheme, and has to approach the Imperial Council of Agricultural Research for help. A detailed estimate of non-recurring and recurring costs is given below. The non-recurring expenditure amounts to Rs. 17,980 of which the State will bear Rs. 7,100. The recurring expenditure amounts to an average of Rs. 5,676 annually, which the State is unable to share. The Council is requested to sanction Rs. 10,880 on account of non-recurring cost and Rs. 28,430 on account of recurring spread over five years. It is estimated that there will be an income of about Rs. 500 on account of produce annually, which can be credited to the Council if it so desires.

It may be added that the State is carrying out another experiment at its own expense. About two years ago 20 Bikanir ewes and 2 rams were purchased from the Karnal Farm through the good offices of Mr. W. Smith. This herd, which now numbers 40, is maintained at Hingoli Stud Farm, with a view to seeing how Bikanir sheep do in the Marahwara or the Deccan Trap area of the State. So far they have thrived and the quality of wool has tended to improve while the quantity per sheep shows an increase. If the flock continues to do well, the possibility of introducing Bikanir sheep as a pure breed into the north-western districts of the State will be considered.

Estimate of Cost of Sheep Breeding Farm.

Non-recurring.

	Rs.
1. Ewes 100 at Rs. 10 each	1,000
2. Rams 4 at Rs. 20 each	80
3. Land 21 acres at Rs. 100 per acre	2,100
4. Fencing	1,600
5. Shelters of breeding stock 4 at Rs. 1,000 each	4,000
6. Shelter for ewes in lamb	500
7. Shelters for lambing 2 at Rs. 250 each	500
8. Shelters for segregation 2 at Rs. 100 each	200
9. Shearing shed	500
10. Sheep Dip	200
11. Well-bore and pump	750
12. Water and feed troughs	400
13. Quarters for Farm manager	5,000
14. Quarters for shepherds and coolies 5 at Rs. 200 each	1,000
15. Office furniture	150
Total	17,980

Hyderabad Government will provide :—

(a) Land 21 acres	2,100
(b) Quarters for Farm manager	5,000
Total	7,100

Net amount required from the Council **10,880**

Recurring.

No.	Particulars.	I Year.	II Year.	III Year.	IV Year.	V Year.	Total.
1	2	3	4	5	6	7	8
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Farm Manager @ Rs. 110— 5—130 per mensem.	1,320	1,380	1,440	1,500	1,560	7,200
2	Kamgar @ Rs. 25—1—29 per mensem.	300	312	324	336	348	1,620
3	Peon @ Rs. 12 per mensem	144	144	144	144	144	720
4	Shepherds 4 @ Rs. 15 per mensem	720	720	720	720	720	3,600
5	Boys 4 @ Rs. 8 per mensem	384	384	384	384	384	1,920
6	Coolie 1 @ Rs. 12 per men- sem.	144	144	144	144	144	720
7	Rent of grazing area 200 acres @ Re. 0-8-0 per acre.	100	100	100	100	100	500
8	Grain feed	1,200	1,200	1,200	1,200	1,200	6,000
9	Fodder for dry months ..	500	500	500	500	500	2,500
10	Replacement of sheep ..	120	120	120	120	120	600
11	Medicines, etc.	100	100	100	100	100	500
12	Stationery	60	60	60	60	60	300
13	Postage	30	30	30	30	30	150
14	Travelling allowance ..	200	200	200	200	200	1,000
15	Peons livery	35	10	10	35	10	100
16	Miscellaneous unforeseen ..	200	200	200	200	200	1,000
	Total	5,557	5,604	5,676	5,773	5,820	28,430

ENCLOSURE II.

HYDERABAD SHEEP BREEDING SCHEME.

The Royal Commission on Agriculture in India, while recording their opinion on the need and prospects of improvement of sheep-breeding industry in India, said "The expressions of opinion we heard on the prospects of sheep-breeding were sanguine; more sanguine indeed for the immediate future than the existing position and the difficulties to be encountered seem to us to warrant. We recognise the great scope for improvement, and we believe that, in spite of obvious difficulties, great improvements are possible; but the prospects of the get-rich-quick adventurer are no better in the twentieth than they were in the nineteenth century."

Regarding the method to be followed for breeding, the Commission said, "We recommend that the main energies of livestock experts now resuming the work should be concentrated on a study of the best indigenous types and that the building up of a ewe flock with definite characteristics should be aimed at, before modification of these characteristics by crossing is decided upon." The matter was discussed at the last meeting of the Animal Husbandry Wing of the Board of Agriculture, held in February, 1933, at Delhi, and they, while welcoming the sustained experiments in crossing of Merinos with specially graded indigenous breeds, were of the opinion, that improvement can best be accomplished by the establishment in each province and State of selected flock of the better indigenous breeds with the object of providing a nucleus of sufficient purity to render possible the resuscitation of each breed. The need and possibilities of improvement are already well recognised, and there is, therefore, no necessity of stressing upon it any more. Experiments in crossing the indigenous breeds with foreign breeds are already in progress on some farms, and the results seem to be promising. But, much more work is necessary. And, both the Royal Commission and the Board of Agriculture are of the opinion that the best method would be to start with selection in the indigenous breeds.

According to the report of the Royal Commission, the total number of sheep in British India is 23 millions, of which 11 millions are in the Madras Presidency and 4 millions in the Punjab. All other provinces have smaller numbers. The sheep population in the Hyderabad State is about 6 millions. Therefore, Hyderabad State is the most important province after Madras, in the matter of sheep-breeding industry. A fairly large quantity of wool is produced, most of which is used locally in manufacture of carpets and rugs, while the rest is exported to the woollen mills outside the State. The export from the State last year amounted to the value of Rs. 5,15,000 of which 3,78,000 represents carpets and rugs and 1,37,000 raw wool.

The amount of wool produced per sheep is only about a pound per head per shearing and 3" to 4" long. It is common to find individual sheep of which the wool is much above the average, which shows that there is possibility of improvement. It is, therefore, desirable that attempt should be made to increase the quantity of wool and to improve its quality, as far as possible. A proposal to start a sheep-breeding farm in Hyderabad for this purpose was worked out some two or three years back and sanctioned by the Government of His Exalted Highness, but has since been held up for want of funds. The idea is to secure the best animals procurable and then to grade up by selective breeding for quantity and quality of wool. The sheep in Hyderabad are mainly black and white, or of every shade of brown between. The dominant colour and the one which is more popular with the breeders in the country and for manufacture of blankets in villages is black, while white is considered more valuable from export point of view. It is proposed to start a breeding farm with the following herds :—

- (1) One flock of 100 ewes and four rams of the black kind, and
- (2) One flock of 100 ewes and four rams of the white kind.

When rams possessing the desired improved qualities are bred, they will be issued to professional sheep-breeders of the neighbouring villages, and all such flocks to which improved rams are issued will be officially registered.

Most of the sheep in the Hyderabad State are in the south-eastern and eastern parts called Telingana, which adjoin the north-western and northern districts of the Madras Presidency and the south-eastern districts of the Bombay Presidency. The farm is proposed to be located in the Mahbubnagar district which is the centre of the sheep-breeding area of Telingana. Conditions being similar to a great extent, the results achieved at this farm will be of value to the neighbouring provinces. There is another advantage in Hyderabad. The State has a Textile Institute in which there is a wool spinning and weaving plant. There is also a Government Industrial School at Mukthal in Mahbubnagar district where spinning and weaving wool materials is specially taught. All work in connection with testing of wool can be done at these institutions without incurring any extra expenditure. The services of the Civil Veterinary Department of the State are, of course, available for study and control of parasitic and other diseases.

The State is spending and has to spend a lot of money on development of its Agricultural Department, apart from the difficulties on account of the unfortunate financial stringency. It is, therefore, unable to finance this scheme, and has to approach the Imperial Council of Agricultural Research for help. A detailed estimate of non-recurring and recurring costs is given below. The non-recurring expenditure amounts to Rs. 28,010 of which Rs. 18,050 will be contributed by the Hyderabad Government. The recurring expenditure amounts to an average of Rs. 7,100 annually, i.e., Rs. 71,000 for ten years, of which Rs. 3,000 will be contributed by the Hyderabad Government. The Council is requested to sanction Rs. 9,960 non-recurring and Rs. 68,000 recurring spread over ten years. It is expected that there will be an income of about Rs. 1,000 on account of produce annually, which can be credited to the Council if it so desires.

It may be added that the State is carrying out another experiment at its own expense. About two years ago 20 Bikanir ewes and 2 rams were purchased from the Karnal Farm through the good offices of Mr. William Smith. This herd, which now numbers 40, is maintained at the Hingoli Stud Farm, with a view to seeing how Bikanir sheep do in the Maratwara or the Deccan Trap area of the State. So far they have thrived, and the quality of wool has been well reported on, while the quantity per sheep is satisfactory. If this flock continues to do well, the possibility of introducing Bikanir sheep as pure breed into the north-western districts of the State will be considered. Two shearings a year were done and the average yield of wool per shearing has been $2\frac{1}{2}$ to 3 lbs. per sheep and the length of wool 4" to 5". The spinning qualities have been reported on as capable of 80's counts. Experiment is being now made to test the growth of wool from summer to summer by taking only one shearing.

ESTIMATE OF COST OF SHEEP-BREEDING FARM.

NON-RECURRING.

	Rs.
1. Ewes 200 at Rs. 8 each	1,600
2 Rams 8 at Rs. 20 each	160
3. Land for paddocks, 50 acres at Rs. 100 per acre	5,000
4. Fencing for paddocks	2,000
5. Shelters for breeding stock 4 at Rs. 500 each ..	2,000
6. Shelters for ewes-in-lamb 2 at Rs. 500 each ..	1,000
7. Shelters for lambing 2 at Rs. 250 each ..	500
8. Shelters for segregation 2 at Rs. 100 each ..	200
9. Shearing shed	1,500
10. Sheep Dip	200
11. Shearing machines 2 at Rs. 150	300
12. Well-bores and pumps 2 at Rs. 750 each ..	1,500
13. Water and feed troughs	1,000
14. Quarters for Farm Manager	5,000
15. Quarters for shepherds 6 at Rs. 200 each ..	1,200
16. Office furniture	500
17. Equipment for spinning and weaving experiments	4,350
Total ..	<u>28,010</u>

Deduct contribution of Hyderabad State :

	Rs.
(a) Land for paddocks	5,000
(b) Fencing	2,000
(c) Quarters for Farm Manager	5,000
(d) Quarters for shepherds	1,200
(e) Office furniture	500
(f) Equipment for spinning and weaving experiments	4,350
	<u>18,050</u>

Actual amount required from the Council .. 9,960

RECURRING.

	Average annual cost.
	Rs.
1. Farm Manager at Rs. 150—10—240 per month ..	2,400
2. Clerk at Rs. 30—2—48 per month	468
3. Kamgar at Rs. 30—2—48 per month	468
4. Peon at Rs. 12—14—14 per month	154
5. Shepherds 6 at Rs. 15 each per month	1,080
6. Watchman for night at Rs. 12 per month	144
7. Rent for grazing area 600 acres at Rs. 0-8-0 per acre	300
8. Extra feeding charges	1,000
9. Replacement of sheep at 10 per cent.	176
10. Medicines	250
11. Stationery	100
12. Postage	50
13. Travelling allowance	250
14. Peon's livery	18
15. Miscellaneous and unforeseen	242
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Total for one year	7,100
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	Rs.
Deduct contribution of Hyderabad State on account of rent of grazing area	300
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Actual amount required from the Council	6,800
Total amount required from the Council for ten years	68,000
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NIZAMUDDEEN HYDER,
Director of Agriculture,
H. E. H. the Nizam's Dominions.

ENCLOSURE III.

Copy of letter No. F. 32 (1)/34/Vet., dated the 4th August 1934, from the Secretary, Imperial Council of Agricultural Research, to the Secretary to Government, Department of Commerce and Industry, H. E. H. the Nizam's Government, Hyderabad-Deccan.

HYDERABAD SHEEP BREEDING SCHEME.

I am directed to refer to your letter No. 6688, dated the 17th June 1934, and to say that the scheme forwarded therewith has been included in the agenda for the forthcoming meeting of the Advisory Board, Imperial Council of Agricultural Research. The scheme will, however, be examined in the first instance by the Cattle Breeding Committee and its report submitted to the Board.

2. In this connection, I am to observe that it will help the consideration of the scheme if information were furnished on the following points :—

- (a) Whether it is proposed to bring all sheep breeding work under one control ;
- (b) What arrangements are proposed for the control of extension work amongst breeders throughout the State ; and
- (c) Who should be responsible for direction of the work at the proposed farm in Mahbubnagar District, and for correlation of the work at this farm with that already in progress at the Hingoli Farm ?

3. A very early reply is requested.

APPENDIX XXVII-A.

NOTE DATED THE 30TH AUGUST 1934, ON SUBJECT No. 27, REVISED SCHEME FOR RESEARCH OF SHEEP BREEDING IN HYDERABAD STATE.

In continuation of paragraph 3 of the note dated the 2nd August 1934, on the subject mentioned above, the attached letter from His Exalted Highness the Nizam's Government No. 8795, dated the 22nd August 1934 (with enclosure) is circulated for the consideration of the Advisory Board.

COPY OF LETTER FROM H. E. H. THE NIZAM'S GOVERNMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 8795, DATED THE 22ND AUGUST 1934.

SUBJECT :—*Hyderabad Sheep Breeding Scheme.*

With reference to your letter No. F. 32-(1)|34|Vet., dated the 4th August 1934, I have the honour to forward herewith a copy of the Director of Agriculture's letter No. 11083, dated the 8th Mehir 1343 Fasli, on the above subject, for your information.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, ADDRESSED TO THE SECRETARY TO GOVERNMENT, DEPARTMENT OF COMMERCE AND INDUSTRIES, H. E. H. THE NIZAM'S GOVERNMENT, HYDERABAD DECCAN, No. 11083, DATED THE 8TH MEHIR 1343 FASLI.

SUBJECT :—*Regarding Hyderabad Sheep Breeding Scheme.*

I have the honour to request you to kindly refer to your letter No. 8377, dated the 5th Mehir 1343 Fasli, and to the letter of the Secretary, Imperial Council of Agriculture Research a copy of which has been forwarded with the same. The answers to the questions in the second para. of the letter of the Council are as follows :—

- (a) The policy and programme of cattle and sheep breeding in Hyderabad State is controlled by the Special Cattle Breeding Committee, the members of which are the Director-General of Commerce and Industries, Directors of the Agricultural and Veterinary Departments and the Superintendent of the Himayatsagar Cattle Breeding Farm. This Committee will control all sheep breeding work in the State so far as policy and programme of work is concerned.
- (b) The policy and programme of extension work amongst breeders will be controlled by the Cattle Breeding Committee mentioned above, and its administration will remain with the Veterinary Department (as is the case in the matter of cattle breeding).
- (c) The Mahbubnagar Sheep Breeding Farm will remain under the Director of Agriculture for administrative purposes. The Hingoli Farm is under the Director of the Veterinary Department, for administrative purposes. The policy and programme of work of both will be controlled by the Cattle Breeding Committee mentioned above. The Committee will be the agency for correlation.

APPENDIX XXXVIII.

NOTE DATED THE 21ST AUGUST 1934, ON SUBJECT NO. 36 (vi), ANNUAL REPORT OF DR. A. E. SLATER'S GOAT BREEDING SCHEME FOR 1933-34.
(NOT PRINTED.)

Attention is invited to the enclosed report on the scheme for breeding experiment as in connection with the improvement of goats conducted by Dr. A. E. Slater at the Mission Poultry Farm, Etah for the year 1933-34. This is the third annual report. The first and second annual reports have already been considered by the Advisory Board.

2. This report will be examined by the Standing Cattle Breeding Committee which will meet in conjunction with the forthcoming meeting of the Advisory Board and the report of the Committee will be circulated to the members of the Board in due course.

APPENDIX XXXIX.

NOTE, DATED THE 30TH JULY, 1934, ON SUBJECT No. 33, APPLICATION FROM THE GOVERNMENT OF BENGAL FOR A SUPPLEMENTARY GRANT OF Rs. 15,571 IN CONNECTION WITH THE APPOINTMENT OF PHYSIOLOGICAL CHEMIST TO STUDY ANIMAL NUTRITION PROBLEMS AT DACCA.

Attention is invited to the attached letter (Enclosure I) from the Government of Bengal, No. 123-T.|A. & I., dated the 12th May 1934, on the subject mentioned above. The Advisory Board at its meeting held on the 15th January 1931 recommended a scheme costing about Rs. 48,590 spread over a period of 5 years for the appointment of a Physiological Chemist to study Animal Nutrition problems at Dacca and this was sanctioned by the Governing Body at its meeting held on the 12th May 1931. The scheme was started on the 2nd January 1932 and its first Annual Report was submitted to the Advisory Board in August 1933, and the extracts from the proceedings of the meeting of the Board will be found in Enclosure II.

2. The Government of Bengal have now applied for (i) a supplementary grant of Rs. 15,571 (Rs. 5,051, non-recurring and Rs. 10,520 recurring) spread over a period of two years in order to carry out certain nutritional experiments that have already been undertaken and (ii) a further extension of the original scheme though no specific period has been stated. The Provincial Agricultural Research Committee has approved the proposal for the supplementary grant and has not recorded any remarks on the question of extension. The proposals will be examined by the Standing Animal Nutrition Committee and the report of the committee will be circulated to the members of the Advisory Board in due course.

3. Meanwhile the papers are circulated to the Advisory Board.

ENCLOSURE I.

COPY OF A LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BENGAL, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURE RESEARCH, No. 123-T.|A. & I., DATED THE 12TH MAY 1934.

SUBJECT :—*Submission of applications for grants from the funds of the Imperial Council of Agricultural Research.*

I am directed to invite a reference to your letter No. D. 735|G.34 (not printed), dated the 13th March 1934 on the subject mentioned above, and to say that the revised procedure laid down therein for submission of schemes for consideration of the Advisory Board of the Council has been noted.

2. I am to forward herewith, for favour of inclusion in the agenda of the meeting of the Advisory Board to be held in July 1934, the marginally noted scheme (Annexure I) which has been approved by the Bengal Provincial Agricultural Research Committee

Proposal for a supplementary grant for the animal nutrition scheme in Bengal.

together with relevant extracts (Annexure II) from the minutes of the meeting of the Committee held on 9th May 1934. I am to say that the Government of Bengal (Ministry of Agriculture) recommend the scheme subject to the condition that no financial liability devolves on them.

ANNEXURE I.

Proposal for an increased grant for the Bengal Animal Nutrition Scheme.

The original scheme proposed investigations at four places in Bengal—Dacca, Rangpur, Chinsura and Berhampore. Actually work was begun in two of these places, i.e., Dacca and Rangpur. At each of these places 8 deshi bullocks were put under experiment. Paddy straw, Hyacinth, Napier grass and Guinea grass were the fodders first taken up and some interesting results were obtained. Later, an extensive experiment with *amon* paddy straw and linseed cake was carried out in 18 individual tests, in order to get at the correct digestibility figure of paddy straw. This is leading to the possibility of a new method for calculating the digestibility of individual feeds. Other work is being carried out on the evaluation and use of two more or less waste products of the province, i.e., rice polishings and molasses.

At each place also four young heifers were selected with the idea of finding out the effect of mineral feeding on the calves and on the milk. Unfortunately no actual test has yet been done on these animals.

The present staff which consists of one Physiological Chemist and one Assistant Chemist have found out that the number and nature of the analyses required were more than they could cope with. An Assistant from the Agricultural Chemist's section had therefore to be periodically loaned to help with the work. The very numerous calculations which had to be done and the results arising out of these meant further difficulties. It is therefore, essential that if the work which has been undertaken should be carried out successfully another Assistant will have to be appointed as early as possible. It should be noted that up to now the work has been mainly confined to Dacca and only one or two tests have been done at Rangpur owing to lack of staff.

Owing to the closing of the Cattle Farm at Rangpur the Animal Nutrition Section has been transferred from Rangpur to Krishnagar.

At present there are two fieldmen, one stationed at Dacca and the other at Krishnagar. Both of them are required to work for long hours in the morning and evening; and when a test is on, they have to attend and inspect off and on during the whole night intermittently.

Over and above this, the collection of fæces, feeds, urine, etc., their weighment, sampling, bottling, etc., has to be conducted by them at a time when on one side the pressure of work is the heaviest and on the other there is the meticulous need of scrupulous care, as the entire reliability of the work rests on how this collection and sampling is attended to. Under the existing conditions it has been found imperative to place one of the assistants from the Laboratory to supervise part of this work at the time of sampling and giving of feeds, but this puts a great handicap on the laboratory side of the work. At Bangalore the stall is in charge of two men. The necessity of two officers is strongly felt both for Dacca and Krishnagar. It is the intention however that the new incumbent will have additional duties of a more difficult nature. A small laboratory is intended to be set up at Krishnagar and he will have to conduct the daily estimation of dry matter

on the spot there during the whole tenure of each kind of feeding. He will also be responsible for the collection of sample fodders from other parts of the province. He should have a higher qualification than a fieldman and hold a University degree or an agricultural diploma.

Non-recurring charges.—During the submission of the first nutrition scheme some provision was made for laboratory apparatus necessary for the conduct of the work. It was thought that the articles available at the laboratory here would ordinarily be sufficient to meet the need. But the varied requirements made such a heavy demand that the work is considerably delayed from shortage of apparatus. In view of this Rs. 400 were obtained in addition during 1933-34 to meet the immediate requirements.

A Duboseq calorimeter is urgently required; the Dacca University spares this apparatus every now and then but difficulty arises when it is required simultaneously at either place. The ignition in connection with fodder analyses requires a large number of burners as well as space and takes a long time. An electric furnace can serve the purpose more efficiently being much quicker and requiring less space. A weighing machine for Krishnagar is amongst the non-recurring charges put up.

Recurring charges.—These are meant to supplement the present scheme already in force since 1932. In this, however, provision has been made for books and periodicals as the absence of these is a serious handicap in the conduct of the present work. The other items refer to stationery, contingent charges, apparatus and chemicals.

Tour charges.—With the increase of staff as suggested, more work will be undertaken at Krishnagar and so more money will be required. It is also intended to obtain fodder and soil samples from different parts of the province as far as possible.

Non-recurring charges.

	Rs.
Drying oven size 4 (Gallen Kamp)	240
Drying oven slightly smaller for Krishnagar ..	180
Desiccator In. Dia. 30 cm. 2.. ..	72
Desiccator In. Dia. 15 cm. 2.. ..	27
Precision Balance Orthling No. 21, d 3374 (Gallen Kamp) to carry 5 kilos.	170
Weight box 2 kilos to 1 gm. 2	126
Weight box 300 gm. to 1 mgm. 2	26
Electric furnace	510
Calculating machine for addition (in type) ..	500
Sundry chemicals and apparatus	500
Animal weighing bridge for Krishnagar ..	2,200
Shed	500
Total (Non-recurring charges) ..	5,051

Recurring charges.

	1st year.	2nd year.
	Rs.	Rs.
One assistant at Rs. 160 per month	1,920	1,920
One field assistant at Rs. 70 per month	840	840
Two night watchmen at Rs. 15 per month	360	360
Tour charges	500	500
Other recurring charges—		
	Rs.	
Contingencies	300	
Stationery	40	
Chemicals and apparatus	800	
Books and periodicals	500	
	1,640	1,640
Total (Recurring charges)	5,260	5,260
		=10,520
Grand Total (Recurring and non-recurring charges)		15,571

Since this scheme is supplementary to the original scheme on animal nutrition its term should for the present be limited to the tenure still remaining for the latter. The original scheme will operate up to the 1st January 1937 and this supplementary scheme should for the present be sanctioned till then. At the same time it should be stated that the five years' period sanctioned for the original scheme is far too short and further extension should be favourably considered in view of the important nature of the work and its utility.

ANNEXURE II.

EXTRACT FROM MINUTES OF THE 8TH MEETING OF THE BENGAL PROVINCIAL AGRICULTURAL RESEARCH COMMITTEE HELD ON WEDNESDAY, THE 9TH MAY 1934.

Proposal for a supplementary grant for the animal nutrition scheme in Bengal :—

Mr. Carbery explained that with the expansion of the work it was found impossible to carry on with the staff at present sanctioned. The regular staff of the Agricultural Chemist had as far as possible helped in the work of the nutrition section, but it is now found impossible to carry on, and the increase of staff was asked for on this account.

Dr. Ghosh enquired whether, with the limited number of animals under experiment the results could be reliable : and Mr. Carbery stated that the work that had been done had been critically examined under two different methods and found to be statistically sound.

Professor Mukherji asked whether with a large number of animals more accurate results could not be obtained, and it was explained that a large number of animals meant a large staff and more laboratory accommodation, which was not available at the Dacca Farm.

The proposal was approved by the Committee.

* * * * *

ENCLOSURE II.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD IN AUGUST 1933.

* * * * *

Report for the year 1932-33 on the Scheme for the appointment of a Physiological chemist to study Animal Nutrition problems at Dacca. [Subject No. 44-B. (1).]

Colonel Olver introduced the report of the Committee (Enclosure) appointed to consider these Progress Reports. With regard to the criticism of the Committee on the Dacca Nutrition Scheme, Mr. Carbery explained the lines on which work was being done at Dacca and said that the Committee were not justified in drawing the conclusion contained in the report. He said that he would like the Committee to amend this part of their report. Dr. Lander explained the view of the Committee—Mr. Iyer entirely agreed with the remarks made by Dr. Lander. The Chairman explained that through an oversight Mr. Carbery was not present at the Committee when this report was examined as he was sitting on another Committee at the time, otherwise these technical details could have been thrashed out. In his opinion the Board was unable to either endorse or to reject the report of the Committee. He therefore commended the remarks of the Committee to Mr. Carbery for consideration.

* * * * *

ENCLOSURE.

EXTRACT FROM THE REPORT OF THE COMMITTEE APPOINTED TO CONSIDER ANIMAL HUSBANDRY AND VETERINARY PROGRESS REPORTS HELD IN AUGUST 1933.

Dacca Nutrition Scheme.

The Committee agree that the objects of the investigation are sound but the report on the 1st year's work does not indicate that the planning and execution of the experimental work has been carried out on sufficiently scientific and precise lines. They therefore conclude that the results presented must be accepted with considerable reserve.

The Committee recommend that the scheme of work should be referred to the Physiological Chemist, for redrafting in consultation with the Officer-in-Charge of the work.

As regards animal nutrition schemes in the future they recommend that after the scheme has been accepted by the Advisory Board and Governing Body a detailed plan of the experiments should be submitted to the Standing Committee on Animal Nutrition for approval before the work is commenced.

Progress reports on the work should also be examined by the Standing Committee.

APPENDIX XL.

NOTE, DATED THE 17TH AUGUST 1934, ON SUBJECT No. 4, REPORT ON COCONUT ENQUIRY IN INDIA BY DR. J. S. PATEL, Ph.D.

At its meeting held in February 1933 the Advisory Board recommended the appointment of a whole time officer for a period of three to six months to conduct an enquiry into the supply of coconut products and coconut oil in India in order that real facts of the position in South India may be obtained (*vide* page 13 of the printed proceedings of the meeting). The recommendation of the Advisory Board was accepted by the Governing Body in circulation and Dr. J. S. Patel, Ph.D., Oilseeds Specialist, Coimbatore, was appointed to conduct the enquiry which took over six months.

2. The report submitted by Dr. Patel is now for the consideration of the Advisory Board.

3. The report has not yet been released for publication and may kindly be treated as confidential till it is published. The question of its publication is also for the Board's consideration.

APPENDIX XLI.

REPORT OF THE FRUIT RESEARCH SUB-COMMITTEE, 5TH SEPTEMBER 1934.

Present :—

Diwan Bahadur Sir. T. Vijayaraghavacharya (*Chairman*).

Mr. E. J. Bruen.

Dr. W. Burns.

Mr. B. C. Burt.

Mr. M. Carbery.

Mr. J. N. Chakravarty.

Khan Bahadur Maulvi Fateh-ud-Din.

Mr. K. Gopalkrishna Raju.

Mr. R. H. Hill.

Mr. H. C. Javaraya.

Mr. A. M. Livingstone.

Mr. J. D. Mahendra.

Mr. J. A. Manawar.

Mr. A. Mohiuddin.

Mr. A. M. Mustafa.

Mr. Nizamuddin Hyder.

Lieut.-Colonel G. Noel.

Mr. S. V. Ramamurty.

Mr. P. B. Richards.

Mr. J. H. Ritchie.

Mr. C. V. Sane.

Mr. D. R. Sethi.

Mr. G. T. Tait.

2. *Application from the Andhra University for a grant of Rs. 18,200 spread over a period of five years for a study of fruits and vegetables with a view to their utilisation in manufacture.* (Subject No. 37, Appendix XLII).—The Sub-Committee recommends that this scheme be referred back to the Andhra University for reconsideration with the suggestion that the author of it should familiarise himself with the work which has already been carried out in India on this subject and with work now in progress and that, if possible, he should visit both Lyallpur and Poona to see the work in progress there. After that he might submit a revised scheme if he so desires. Any revised scheme should be accompanied by much fuller detail of the experimental work which it is actually proposed to undertake.

3. *Application from the Government of the North-West Frontier Province for a grant of Rs. 27,350 spread over a period of five years for research on the improvement of fruit culture in the North-West Frontier Province and the problem of marketing.* (Subject No. 38, Appendix

XLIII).—The Sub-Committee considers that, in view of the great opportunities for the development of fruit cultivation which exist in the North-West Frontier Province and the facilities for experimental work on an established orchard which exist at the Tarnab farm, a Horticulturist on an average salary of about Rs. 300 per mensem should be provided by the Council for a period of five years. The actual programme of work submitted is of a very general character but it would be unreasonable to ask for a detailed programme until a Horticulturist is appointed. The Sub-Committee therefore recommends a grant of approximately Rs. 20,000 for the five years period for the provision of a Horticulturist. The Sub-Committee considers that many of the other items of the scheme represent expenditure which should be undertaken by the Local Government.

4. *Application from H. E. H. the Nizam's Government, Hyderabad, for a grant of Rs. 58,610 spread over a period of five years for a fruit research scheme. (Subject No. 39, Appendix XLIV)*.—The Sub-Committee recommends that the proposed scheme of work be approved so far as Custard apples and Grapes are concerned but does not recommend the undertaking of work on pineapples in Hyderabad. The sub-committee considers that the whole of the non-recurring expenditure should be met by the Hyderabad State as it practically all represents permanent additions to State property. With regard to recurring expenditure the sub-committee recommends that for the programme of work now approved there should be employed one Assistant Horticulturist on a scale of Rs. 200 to Rs. 300 per mensem instead of one Superintendent and one Assistant. Two *malis* will now be sufficient and working charges can be reduced to Rs. 2,000 per annum. With these modifications which will reduce the cost to some Rs. 43,160, the scheme is recommended for sanction. It is to be understood that work on custard apples would include all types of anona.

5. *Application from the Government of Mysore for a grant of Rs. 88,880 spread over a period of five years for a scheme for fruit cultivation in the Mysore State. (Subject No. 40, Appendix XLV)*.—In the opinion of the Sub-Committee, having due regard to the work which is already in progress on other fruit research schemes or which has recently been sanctioned, this scheme should be limited to two, *viz.*, apples and miscellaneous fruit (which would include pineapples). It does not consider that work in Mysore on grapes, citrus and mangoes need be financed by the Council. The area of the experimental orchard proposed for apples is somewhat too small and should be increased to 25 acres, that for miscellaneous fruit being fixed at 20 acres making a total under fruit cultivation of 45 acres instead of the 100 acres originally proposed. It is understood that at least 40 acres can be planted up in the first year.

It will be noted that the Mysore Government is providing all non-recurring expenditure in connection with the scheme.

Financial details.—In view of the reduced area the appointment of an Assistant Farm Manager may be postponed until necessity arises. Instead of a number of Foremen varying from one to four the sub-committee recommends that two be appointed for the whole period. The Plant Propagator should be provided for the first two years of the scheme only. As the Mysore Department of Agriculture has strong Mycological and Entomological sections, it is considered unnecessary to appoint an

Assistant Mycologist and an Assistant Entomologist for this scheme but one Scientific Assistant (grade Rs. 75—5—100) will be required and also one laboratory Attendant. The sub-committee recommends that only one clerk be provided and no storekeeper.

Subject to the above amendments which reduce the cost to about Rs. 43,000 the sub-committee recommends that the scheme be sanctioned.

The total amounts required for maintenance during the five years of the scheme as now revised, were as follows :—

	Rs.
1st year	4,200
2nd year	4,200
3rd year	3,360
4th year	3,360
5th year	3,360
Total	18,480

Subject 41. Proposal to appoint three Assistants on Rs. 120—10—150 each in the place of the physiological Botanist under the scheme of fruit research in Bihar and Orissa (Appendix XLVI).—It has been ascertained that although a Physiologist with the required experience of fruit work is not at present obtainable in India, facilities for training in the special technique of fruit work, a qualified Indian Physiologist could be obtained either at the East Malling Fruit Research Station or at the Long Ashton Fruit Research Station. Research work in Burma bearing on English fruit trees is in progress at East Malling and the problem is also receiving attention at Long Ashton, and one or other of them (by mutual arrangement) could probably receive an Indian research worker. The problem of alternate bearing in mangoes is one of very great importance to the whole of India and is also a problem of considerable difficulty. The Sub-Committee therefore considers that steps should be taken to train a special research worker for this problem and that is not sufficient to rely entirely on what can be done by the Horticulturist, Bihar and Orissa, who already has a very full programme of work. It recommends that immediate steps be taken to train a Fruit Physiologist. The Director of Agriculture, Bihar and Orissa has undertaken to submit proposals.

In order, however, that such progress as is possible may be made in the meantime, the sub-committee recommends that two Scientific Assistants be sanctioned in the meantime while the Fruit Physiologist is being trained. The cost of these proposals will be met from the existing sanctioned grant.

Subject 42. Reports on the experimental consignments of mangoes from Bombay to Great Britain during 1932 (Appendix XLVII).—No comments are necessary on these reports.

Subject 43. Arrangements made for the examination of experimental fruit consignments from India to the United Kingdom by the Scientific and Industrial Research Department of His Majesty's Government in the

United Kingdom (Appendix XLVIII).—The Sub-Committee desires to invite the attention of all Departments of Agriculture to the facilities for the examination of experimental consignments of fruit which the High Commissioner for India has been able to arrange through the kind assistance of the Department of Scientific and Industrial Research of His Majesty's Government. The Indian Trade Commissioner's note on the subject which has already been circulated explains details and contains his recommendations on the procedure to be followed.

Subject 44. Application from the Government of Madras for a grant of Rs. 74,000 spread over five years for a scheme of research work on bananas (Appendix XLIX).—The Sub-Committee recommends that this scheme be sanctioned subject to certain modifications. It is suggested that practically all the work could best be done at a single station instead of being divided between a number of stations, in particular item 2 of the technical programme involves the growing at a central station of all the varieties collected. This point can be dealt with when the detailed experimental programme is furnished when financial sanction to the scheme is communicated. With regard to the financial details of the scheme, the Sub-Committee considers that the provision for leave contribution should be omitted in all cases as it is not the practice of the Research Council to include such provision in its grants. Secondly, it should be made quite clear that receipts from the scheme will be credited to the Council in accordance with the usual practice.

Subject 45. Programme of work on the Bombay cold storage research scheme for the years 1934, 1935 and 1936 (Appendix L).—The Sub-Committee approved of the programme of work on the Bombay cold storage scheme it having been ascertained that it is acceptable to the several provinces which are co-operating in the supply of material for experiment. The Mysore State desires to be included in the list of co-operating provinces and States ; this was agreed to by the Director of Agriculture, Bombay.

B. C. BURT,
Agriculture Expert.

Dated 5th September 1934.

APPENDIX XLII.

NOTE, DATED THE 26TH MAY 1934, ON SUBJECT No. 37, APPLICATION FROM THE ANDHRA UNIVERSITY FOR A GRANT OF Rs. 18,200 SPREAD OVER A PERIOD OF FIVE YEARS FOR A STUDY OF FRUITS AND VEGETABLES WITH A VIEW TO THEIR UTILISATION IN MANUFACTURE.

Attention is invited to the attached letter from the Government of Madras, No. 446-Ms., dated the 4th April, 1934, (Appendix) forwarding *inter alia* the Scheme mentioned above. The scheme which involves an expenditure of Rs. 18,200 spread over a period of five years is now for the consideration of the Advisory Board.

APPENDIX.

COPY OF A LETTER FROM THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 446-Ms., DATED THE 4TH APRIL 1934.

ANDHRA UNIVERSITY SCHEMES.

I am directed to forward the following schemes submitted by the Registrar, Andhra University, Waltair for financial assistance from the Council—

- | | | | | | | | |
|----|---|---|---|---|---|---|---|
| 1. | * | * | * | * | * | * | * |
| 2. | Study of fruits and vegetables with a view to their utilisation in manufacture, and | | | | | | |
| 3. | * | * | * | * | * | * | * |

(2) The schemes were circulated to the members of the Provincial Research Committee. The first scheme has been recommended by four members, the second by three and the third by six including the Director of Agriculture. In the opinion of the Local Government, however, none of the schemes are deserving of financial aid from the Council.

A SCHEME BY DR. T. R. SESHADRI, M.A., PH.D., HEAD OF THE CHEMISTRY DEPARTMENT, ANDHRA UNIVERSITY, WALTAIR, FOR A GRANT FROM THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

Study of fruits and vegetables with a view to their utilisation in Manufacture.

Research directed towards the improvement of the lot of agriculturists has two aspects ; one aiming at increased production with reduced expenditure and the other aiming at rapid consumption of the agricultural products in local industries. The latter is of very great importance since besides developing the industries of a country it offers better price to the farmer for his commodities and thus stimulates production of agricultural products. As a prerequisite to the starting of industries on modern lines a thorough chemical knowledge of the agricultural products is essential. Equipped with this knowledge their utilisation in industries could be properly tackled in well equipped technological laboratories.

It is well-known that the Andhra districts, particularly those included in the Northern Circars form one of the most important fruit growing areas of India. Fruits and vegetables are important money crops and the agricultural department of the Madras Government are taking active steps to promote this aspect of agriculture. However, very little chemical research work has been done on Indian fruits and vegetables with a view to provide us with sufficient knowledge of their chemical components to enable industries to be started. In this respect we are far behind other countries in the world who have paid a good deal of attention to this line of agricultural research.

With the grant now applied for it is proposed to make a study of chemical composition (Organic and Inorganic) of the important fruits and vegetables of the Northern Circars and explore the possibilities of their utilisation for the manufacture of pickles, jams and marmalades, fruit essences, pure fruit acids such as citric acid, etc., etc. The investigation will not only be of importance to the area above mentioned, but will be of importance for the whole of India since the same kinds of fruits occur in other parts of this country as well. It refers to an industry which has a bright future before it when conducted on right lines with sufficient chemical information.

The Andhra University College of Science and Technology is specially suited for the above investigation. It is situated in an area where the raw materials are available in plenty and in a fresh state. It contains the departments of Chemistry and Chemical Technology and hence offers the necessary conditions for experiments on a commercial scale. The Head of the Chemistry department has over 10 years experience in plant Chemistry and has been working for about 3 years in the Chemistry department of the Agricultural Research Institute, Coimbatore. He will have the co-operation of the Chemical Technologists of the Technology department of this University who have had plenty of experience in the management of factories.

The ordinary laboratory and workshop facilities of the University will be freely available for this investigation.

The scheme will run for 5 years since a shorter period will be inadequate for dealing with the large number of materials that have to be dealt with.

The grant from the Imperial Council will be utilised as under :—

	Rs.
Scholarship for special Research Scholars for 5 years in the scale of Rs. 100—5—120.	12,200
For the purchase of special apparatus, chemicals and raw materials and contingent expenses about Rs. 1,000 a year.	5,000
Total for 5 years	18,200

Qualifications, etc., of Dr. T. R. Seshadri.

*Qualifications, etc., of the applicant.***I. Name :—**

T. R. Seshadri, M.A. (Madras), Ph.D. (Manchester).

II. Age :—

33 years.

III. College courses :—

1917-1922—Scholarship student of the Presidency College, Madras.

1919—Inter examination with Chemistry, Physics and Mathematics as optionals—1st class with distinctions.

1922—B.A. (Hons.) in Chemistry, 2nd class.

1924—M.A.

IV. Post Graduate training and experience :—

(a) *Madras*.—University Research Scholar working with Prof. B. B. Dey, D.Sc., in Organic Chemistry, 1923-27.

Research Work.—

(1) Examination of some medicinal plants of South India.

(2) Study of Quinolono-pyrones, a class of bodies expected to possess medicinal value.

Prizes awarded.—

(1) Sir William Wedderburn Prize of the Madras University, 1924.

(2) Maharajah of Travancore, Curzon prize of the Madras University, 1925 (both by examination of thesis submitted).

University Lectures.—

Delivered a course of six lectures on the Chemistry of Alkaloids under the auspices of the Madras University 1926.

(By Prof. Dey's arrangement I delivered un-officially about 12 lectures on the alkaloids to the Honours students during 1924 and during 1925).

(b) *Government of Madras Technical Scholar in Europe for the study of the Chemistry of Drugs (Pharmaceutical Chemistry) March 1927—May 1930.*

Manchester University, March 1927 September 1928.

Worked with Prof. R. Robinson, D.Sc., F.R.S., Prof. of Organic Chemistry.

Research Work :—

(1) Attempts to find new anti-malarials.

(2) Study of some anthocyanin pigments of plants.

Special courses.—Botany, Materia Medica, Pharmacology and Bacteriology in the Botany and Pharmaceutical departments of the University.

Was awarded the Ph.D., Degree in Chemistry for a thesis in Anthocyanin Chemistry.

London University College.—October 1928—July 1929.

Research work :—

- (1) Continued my work on the Anthocyanins with Prof. R. Robinson.
- (2) Preliminary work in connection with an investigation into the nature of the Pituitary hormones.

Special courses :—

Attended special courses of lectures on

- (1) Vitamins by Prof. J. C. Drummond, D.Sc.
- (2) Assay of Drugs by Dr. Scott of the Pharmaceutical Society.
- (3) Protein metabolism by Dr. Robson.
- (4) Carotinoids and Vitamin A, by Prof. Harrow of Zurich.
- (5) Electronic theory of valency and its application to organic reactions by Prof. R. Robinson.

Graz, Austria, Medical Chemistry Institute of the University—August—October 1929.

With Prof. F. Pregl, M.D., D.Sc., Nobel Laureate.

Special course in Microchemical analysis.

Edinburgh University.—Department of Medical Chemistry, November 1929—May 1930.

Research work.—Worked with Prof. G. Barger, D.Sc., F.R.S. on the examination of the active principles of *Sencio Latifolias*, a South African poisonous shrub (cattle poison).

Special course.—Analytical and consulting work in agricultural chemistry with Mr. A. Cameron, B.Sc., F.I.C., Consulting Chemist and official Agricultural Analyst.

(c) *Madras University Research Fellow.*—Worked in the Presidency College, Madras, July to November 1930.

Worked on :—

- (i) a preliminary examination of the pigments of some Hibiscus varieties.
- (ii) the mechanism of geometrical inversion in the coumaric acids.
- (iii) the re-activity of the double bond in coumarins and related compounds.

V. Present position in Coimbatore :—

Since November 1930, Soil Physicist working as Assistant to the Government Agricultural Chemist in the Agricultural Research Institute, Pay :—Rs. 300 in the grade 250—25—550—25—750.

VI. Original Papers :—

(a) Already published in the *Journal of the Indian Chemical Society*.

- (1) Quinolono pyrones—1926, page 187.
- (2) Quinolono-bromo pyrones and their conversion into quinolino-furanes 1926, page 165.

- (3) Hydroxy-quinolyl acrylic acids 1927, page 189.
- (4) Reactivity of the methylene group in Coumarin acetic acids Part III, 1931, page 247.
- (5) Coumaryl-isocyanate and its reactions 1931, 293.
- (6) Coumaryl-isothiocyanate, 1931—527.
- (7) Geometric inversion in the acids derived from coumarins (in the press).

In the Journal of the Chemical Society, London :—

- (8) The reactivity of the double bond in coumarins and related compounds 1928, page 166.
- (9) Attempts to find new antimalarials, Part II, 1929, 2952.
- (10) Experiments in the synthesis of anthocyanins, Part VII, 1931, page 2672.

In the Indian Journal of Agricultural Science :—

- (11) The use of lactic acid in plant histology, 1932, page 51.

In the Madras Agricultural Journal :—

- (12) The rôle of Protoplasmic pigments in plants, 1932, page 83.

(b) Awaiting publications :—

- (1) Study of the active principles of *Senecio latifolius*.
- (2) Preliminary examination of the pigments of some *Hibiscus* varieties (Abstracts published in the Proceedings of the Indian Science Congress, 1931).
- (3) Reactivity of the double bond in coumarin and related compounds, Part II (abstracts published in the proceedings of the Indian Science Congress, 1931).
- (4) A modified combustion method for the determination of organic carbon in soils (read before the Madras branch of the Indian Chemical Society, 1931).
- (5) A simplified method for the estimation of soil carbonates.
- (6) A note on a peculiar case of gall in the mango fruit (communicated to the Current Science).
- (7) The chemistry of the Cotton Plant, Part I. The glucosides of some important South Indian varieties of cotton.
- (8) The nature of the sugary secretion of the cholam plant (*Tella Jonna*) and the conditions leading to it.

VI. Original investigations in Progress :—

- (1) Movement of soil moisture and its relation to plant growth.
- (2) The effect of cultivation on the structure and properties of soils.
- (3) The constituents of *Psoralea corylifolia* seeds and their utilisation in medicine.
- (4) The chemical study of some coloured rice varieties.

VII. *Special qualifications :—*

- (a) *Professors.*—At the outset I may say that by my association with Professors of world wide reputation and their co-workers, I have not only gained an insight into the particular lines in which I have actually worked but also in the others pursued by my colleagues around me.
- (b) *Foreign travel.*—Besides having worked in premier centres of chemical learning such as Manchester, London, Edinburgh and Graz, I have visited during my travels Europe most of the famous Universities and Research Institutes in Central Europe and France, such as Berlin, Dresden Prague, Vienna, Innsbruck, Zurich, Munich, Paris, etc., and have come into personal contact with well known chemical investigators in these places and studied their work. On account of this I may claim to be well acquainted with (i) the modern theoretical ideas in organic chemistry, (ii) important lines of chemical investigations now in progress in the different centres in Europe, (iii) the laboratory systems and training in vogue in the different centres and I may claim further (iv) to have gained a wide outlook of chemical teaching and research.
- (c) *Pharmaceutical Chemistry.*—As will be evident from what has already been stated I have paid special attention to the Chemistry of plant drugs and I have taken special courses in botany, Materia Medica, Pharmacology, and Bacteriology along with the pharmacy students of the Manchester University. I may also mention here my training in Microchemical Analysis. As a student member of the Pharmaceutical Society I visited most of the Pharmaceutical and chemical works in Manchester, Liverpool, London and Edinburgh and had opportunities of studying them closely.
- (d) *Agricultural Chemistry.*—I may mention in this connection (1) my training with Mr. A. L. Cameron, B.Sc., F.I.C., Consulting Chemist and Official Agricultural Analyst and (2) my experience in the Madras Agricultural Department working in the Chemistry section of the Agricultural Research Institute. The importance of this subject for improving the yield and quality of plant drugs cannot be overstated; the example of Java in connection with production of Quinine using improved methods of Cinchona Agriculture is quite well-known.
- (e) *Languages.*—I have passed the complete Vernacular test in Telugu and I have a fair working knowledge of German having been in Germany for several months.
- (f) *Lecturing Experience.*—During my stay at the Presidency College as a Research Scholar of the Madras University I used to deliver special lectures to the Honours students and in 1926 gave the University Lectures in the Chemistry of the Alkaloids. Prof. Robinson will speak about by capacity as a lecturer from his impressions about me gained during the University Chemical Society meetings and colloquia in Manchester and London.

APPENDIX XLIII.

NOTE, DATED THE 30TH JULY 1934, ON SUBJECT No. 38. APPLICATION FROM THE GOVERNMENT OF THE NORTH-WEST FRONTIER PROVINCE FOR A GRANT OF RS. 27,350 SPREAD OVER A PERIOD OF FIVE YEARS FOR RESEARCH ON THE IMPROVEMENT OF FRUIT CULTURE IN THE NORTH-WEST FRONTIER PROVINCE AND THE PROBLEM OF MARKETING.

Attention is invited to the attached letter (Encls. I) from the Government of the North-West Frontier Province, No. 2966-TDN, dated the 29th June 1934, forwarding the scheme (Encls. II) mentioned above. The scheme involves a total expenditure of Rs. 27,350 (Rs. 4,250 non-recurring and Rs. 23,100 recurring) spread over a period of five years. The North-West Frontier Province Government do not contribute anything in the shape of money towards the non-recurring or recurring expenditure of the scheme, but have offered to provide an established orchard of 40 acres with fruit sheds, offices, etc., of an estimated capitalized value of Rs. 50,000 and to meet the recurring expenditure amounting approximately to Rs. 3,000 per annum on account of manure and spraying material.

2. The Vice-Chairman to the Council considers that it will be an advantage to have the scheme examined in the first instance by the fruit Sub-Committee consisting of :—

- (1) The Vice-Chairman, Imperial Council of Agricultural Research, Chairman (*ex-officio*).
- (2) The Agricultural Expert, Imperial Council of Agricultural Research.
- (3) The Director of Agriculture, Madras.
- (4) The Director of Agriculture, Bombay.
- (5) The Director of Agriculture, Bengal.
- (6) The Director of Agriculture, United Provinces.
- (7) The Director of Agriculture, Punjab.
- (8) The Director of Agriculture, Bihar and Orissa.
- (9) The Director of Agriculture, Central Provinces.
- (10) The Director of Agriculture, Assam.
- (11) The Director of Agriculture, North-West Frontier Province.
- (12) The Director of Agriculture, Hyderabad.
- (13) The Director of Agriculture, Mysore.
- (14) The Director of Agriculture, Baroda.
- (15) The Chief Publicity Officer, Indian State Railways.
- (16) The Agricultural Officer, Baluchistan.

The Secretary, Imperial Council of Agricultural Research,
Secretary (*ex-officio*).

3. This Committee will meet on some convenient afternoon between the 3rd and the 8th September 1934. Its report will be circulated to the Advisory Board in due course.

ENCLO. I.

COPY OF A LETTER FROM CAPTAIN A. E. H. MACANN, SECRETARY TO GOVERNMENT, NORTH-WEST FRONTIER PROVINCE, TRANSFERRED DEPARTMENTS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, NO. 2966-TDN, DATED THE 29TH JUNE 1934.

SUBJECT :—*Research work in the North-West Frontier Province.*

I am directed to refer to your letter No. F. 6(a)|34|G., dated the 11th May 1934 and to enclose a scheme for a grant of Rs. 27,350 spread over five years for research work in the North-West Frontier Province on the improvement of fruit culture and the problem of marketing, with the request that this may be placed on the agenda of the meeting of the Advisory Board to be held at Simla at the beginning of September 1934.

ENCLO. II.

FRUIT RESEARCH SCHEME FOR THE NORTH-WEST FRONTIER PROVINCE.

Application for a grant of Rs. 27,350 spread over five years for research work in the North-West Frontier Province on the improvement of fruit culture and the problem of marketing.

The Royal Commission on Agriculture stresses the importance of fruit culture in India and the need for experiments by the Department of Agriculture, and the Research Council has implemented this recommendation by sanctioning schemes for all the major provinces. The all India importance of the present proposal need not, therefore, be laboured any further.

The culture of deciduous fruit trees namely the peach, plum and pear is probably more developed in the North-West Frontier Province than in any other province of India.

The better known commercial varieties were imported from America, Europe and Japan, commencing from 1910. By 1918, a number had been proved suitable to local conditions. In the last 17 years over half a million budded plants of these varieties have been distributed from the Government Fruit Farm, mainly to the zamindars of the Peshawar District. Many thousands of acres of new orchards have been laid out. The Peshawar District is probably the only large area in India where the fruit growers have laid down commercial orchards of named varieties of deciduous fruit trees.

The Peshawar peaches, especially the No. 6 and the Elberta have a well established reputation in all the big Indian markets.

Last year 261,251 maunds of fruit were exported from Peshawar by rail alone.

At the Government Farm there are 40 acres of established orchards consisting of :—

<i>Fruit.</i>		<i>No. of trees.</i>	<i>No. of varieties.</i>
Peach	.. ..	2,400	7 varieties.
Plum	.. ..	650	7 ..
Pear	.. ..	653	4 ..

Unfortunately owing to lack of funds and staff it has not been possible to take full advantage of these experiments by maintaining proper records. The fruit has been sold on the trees to contractors and there is no register of yield, results of manurial experiment and other cultural methods.

The present scheme provides for systematic experiments and records on the following subjects :—

Manuring.

Thinning.

Pruning.

Spraying.

Irrigation.

Inducing shy fruited trees to yield more freely by such methods as cross-pollination, ringing and root pruning.

Crop record.

Marketing.

Manuring—

A comparison of farmyard, artificial and green manuring or a combination of them in relation to yields, colour, size and flavour.

Thinning—

Testing of thinning on size and market quality.

Pruning—

Effect on shape and size of leaf surface.

Spraying—

Economics of spraying. Search for insecticides within the means of the zamindar.

Irrigation—

Measurements of water.

Determination of additional requirements in connection with green manuring.

Ringing, root pruning and cross pollination to induce shy fruited trees to yield—

A number of the varieties grown at Tarnab are shy fruited. The William Peach has never borne at all. Owing to lack of staff the problem of increasing the yields has not been systematically tackled.

Crop records—

Registers will be kept of the numbers of fruit, the proportion of the grades and the weight in the case of as many individual trees as possible.

Marketing and packing—

Experiments with packing and marketing have been started this year with a view to laying the foundation of a co-operative fruit selling organization.

The scheme now proposed will obviously promote the success of such an organization by the light it should throw on the methods designed to produce the type of fruit that the market demands.

The total cost of the scheme for five years will be Rs. 27,350 of which Rs. 23,100 is recurring and Rs. 4,250 is non-recurring.

The details are shown in the estimates attached to this note.

The contribution of this Government will be in the form of an established orchard of 40 acres with fruit sheds, offices, etc., of an estimated capitalized value of Rs. 50,000. As regards recurring expenditure the normal requirements of the orchards in the way of manure and spraying material, of an estimated annual value of Rs. 3,000 per annum.

In view of the present financial condition, the smallness of the Province and the exiguous nature of its resources (it is a deficit Province to the extent of a crore a year) it is hoped that the Council will consider that the above mentioned contributions are ample and will therefore be pleased to provide the remaining expenditure both recurring and non-recurring.

ESTIMATE OF RECURRING EXPENDITURE.

	Estimate of recurring expenditure.				
	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
One Agricultural Assistant Rs. 100—10—300.	1,200	1,320	1,440	1,560	1,680
Part time services of a clerk at Rs. 50, viz., 12×25—Rs. 300 per annum.	300	300	300	300	300
Two Kamdars	480	480	480	480	480
Manures and spraying material for experiments.	500	500	500	500	500
Labour 10 men at 8 annas a day ..	1,800	1,800	1,800	1,800	1,800
Stationery and Contingencies	100	100	100	100	100
	4,380	4,500	4,620	4,740	4,860
Total recurring					23,100

ESTIMATE OF NON-RECURRING CHARGES.

	Rs.
Quarters for a whole time Agricultural Assistant ..	2,500
Half share in quarters for a part time clerk ..	750
Weighing machines, sprayers ..	1,000
Total Non-recurring ..	4,250

APPENDIX XLIV.

NOTE, DATED THE 27TH JULY 1934, ON SUBJECT NO. 39 : APPLICATION FROM H. E. H. THE NIZAM'S GOVERNMENT, HYDERABAD, FOR A GRANT OF RS. 58,610 SPREAD OVER A PERIOD OF FIVE YEARS FOR A FRUIT RESEARCH SCHEME.

Attention is invited to the attached extract (Encl. I) from the report of the Fruit Research Committee of the Advisory Board held on 21st February 1934 regarding an application from the Government of H. E. H. the Nizam for a grant of Rs. 74,300 for a fruit research scheme in Hyderabad. The report of the Committee was adopted by the Advisory Board and its recommendation was communicated to H. E. H. the Nizam's Government.

2. The Government of H. E. H. the Nizam have now submitted a revised scheme of fruit research [*vide* copy of their letter No. 6665, dated the 16th June 1934 (Encl. II and Annex.)]. This revised scheme involves, so far as the Council is concerned, Non-recurring expenditure of Rs. 10,550 and Recurring expenditure of Rs. 48,060 or a total expenditure of Rs. 58,610 spread over a period of five years.

3. The scheme is for the consideration of the Advisory Board. The Vice-Chairman to the Council considers that it will be an advantage to have the present scheme examined in the first instance by a Committee consisting of :—

- (1) The Vice-Chairman, Imperial Council of Agricultural Research, Chairman (*Ex-officio*).
- (2) The Agricultural Expert, Imperial Council of Agricultural Research.
- (3) The Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, Punjab, Bihar and Orissa, Central Provinces, Assam, North West Frontier Province, Hyderabad, Baroda and Mysore.
- (4) The Chief Publicity Officer, Indian State Railways.
- (5) Agricultural Officer, Baluchistan.

The Secretary, Imperial Council of Agricultural Research--
Secretary (*Ex-officio*).

This Committee will meet on some convenient afternoon between the 3rd and 8th September 1934. Its report will be circulated to the Advisory Board in due course.

ENCLO. I.

EXTRACT FROM THE REPORT OF THE FRUIT RESEARCH COMMITTEE HELD ON 21ST FEBRUARY 1934.

Subject 34 (III). Application from the Government of His Exalted Highness the Nizam for a grant of Rs. 74,300 for a fruit research scheme.

The Committee are of opinion that, in view of the work in progress at Poona and the schemes sanctioned for Madras and Bihar for work on mangoes and recommended for work at Nagpur and Lyallpur on citrus fruits, it is not necessary to finance another research scheme for work on these fruits in Hyderabad. It

is suggested that the scheme should be withdrawn and a scheme of work for research on those fruits for which Hyderabad is specially suitable and which are not already covered by research schemes might be put forward. As tentative suggestions for consideration, the following fruits were mentioned:—

The custard apple, grapes, the papaya. The Committee did not consider Hyderabad a suitable centre for research work on dates. The Director of Agriculture, Hyderabad, agreed to re-examine the scheme in the light of these suggestions.

ENCLO. II.

COPY OF LETTER No. 6665, DATED THE 16TH JUNE 1934, FROM THE OFFICIATING SECRETARY TO GOVERNMENT, DEPARTMENT OF COMMERCE AND INDUSTRY, H. E. H. THE NIZAM'S GOVERNMENT, HYDERABAD-DECCAN, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA.

SUBJECT :—*Hyderabad Fruit Research Scheme.*

With reference to your letter No. F. 278/33-A, dated the 12th April 1934, I am directed to forward herewith as desired a revised scheme of work for research on fruits in Hyderabad.

The revised Scheme includes custard apple, grapes and pine apple. Of these the first two are according to the tentative suggestion of the Committee. Papaya, another fruit suggested by the Committee, has not been included for the reason that though it can be grown quite successfully in Hyderabad it has no market. Instead of that pine apple has been included which can be grown successfully and has a good market.

The revised scheme may kindly be placed before the Advisory Board at its next meeting. Printed copies of the scheme will be sent to you by the Director of Agriculture in due course.

ANNEXURE TO ENCLOSURE II.

HYDERABAD FRUIT RESEARCH SCHEME.

The Dominions of His Exalted Highness the Nizam include within their boundaries soils of many different kinds, and possess a moderate climate. A great variety of trees grow there successfully, therefore, and fruit trees of a very large number of different kinds are seen growing scattered here and there, besides numerous regular gardens. But in spite of this, the fact is that the Hyderabad State, instead of being an exporter is an importer of fruit. It imports fresh fruit alone to the value of about twelve lakhs of rupees annually. To investigate the reasons and to find out the possible lines of development, the Hyderabad Government decided in 1930 to make a survey of the fruit growing industry in the State. A fairly detailed enquiry was made, which took about two years to complete and cost the Government about Rs. 14,000. At the same time another attempt was made to gauge the interest of the farming and cultivating class in fruit culture, and actually to see what sort of fruit is now produced, by holding a Horticultural show in 1931. A great variety of fruits, some of them very good ones, were brought for competition from all parts of the State. The show has become an annual function now, and the fourth was held about the end of January 1934. The public in general and the farming and gardening class in particular are aroused and are taking more and more interest in fruit, because

they have actually seen what possibilities there are for development. The detailed study in connection with the fruit survey has brought to light the fact that there is a very great scope for development. Great facilities are available now for irrigation from the large reservoirs which the Government has constructed at an expense of some crores of rupees. The Nizamsagar reservoir alone is expected to irrigate about 2,25,000 acres. The State is now in possession of definite information about the present condition of the industry, the scope for its development and the definite lines on which improvement is possible. The enquiry has shown that the chief thing which is required is technical guidance and technical workers and a supply of good reliable stock. There is a very great demand for this already, but unfortunately the State Agricultural Department is not sufficiently equipped to meet it. No technical advice can safely be given until experience has been gained by practical research, no technical workers can be made available until training is given, and no reliable stock can be supplied until such stock has been searched out and propagated.

The Hyderabad Agricultural Department is in possession of the services of a trained Horticulturist. One of the members of its Sub-ordinate Agricultural Service, who is a Licentiate in Agriculture of the Nagpur Agricultural College went to America after serving in the Department for about 12 years, in various capacities upto the Superintendent of a Government farm and garden. On his return from America, where he obtained the M.Sc., degree in Horticulture, he was deputed to Poona for six months for further practical training in the same subject under the Horticulturist of the Bombay Government. This officer has now been given charge of all horticultural work in the State.

It will be seen from the above that the Hyderabad Agricultural Departmental is now fully prepared to embark on a scheme of serious horticultural development, if it can secure necessary funds. But we are unfortunately faced now with unfavourable financial conditions, and the Government is unable to give effect to any new scheme. It is under these circumstances that the Imperial Council of Agricultural Research is being approached for help. The Council is asked to sanction a grant for a garden for research work in connection with fruit growing. This garden will be established in Hyderabad at the headquarters of the Horticulturist so that it may be under his direct control.

Work proposed to be undertaken.

For the present it is proposed to concentrate work on custard-apple, grapes and pine-apples. Custard-apple is a common fruit in the granite area of the State. It is growing in wild form on the poorest stony land, which is unfit for most other crops. It is estimated that there are no less than 56,000 acres of land under it. It is produced in such an abundance that it goes to waste unused in very large quantities, though some of it is exported to Bombay. The development of this fruit and finding out of methods of utilising the surplus produce will not only make the otherwise waste lands productive but will also provide means of livelihood to the poorer class of rural population. Grapes can be grown successfully in the State. There are already some promising gardens there, which occasionally yield some profit to their owners. But the varieties grown are very shy in bearing, and the proper methods of cultivation and

training the vines and pruning them are not known to the people. Hence the industry is not making the progress that it should do. Pine-apples are at present grown in a few private gardens successfully. The small experimental plots at the Government farms are also in promising condition, and are in fruit now. The survey has shown that it can successfully be grown on a much larger scale, if suitable varieties and proper methods of cultivation are found out. The details of the problems of research proposed to be taken up are given below. It may be pointed out that the three crops proposed for research are those on which no systematic work is at present being carried out in South India. As Hyderabad State is situated in the centre of the Deccan, it is expected that the results of the work carried out there, will be of use to the neighbouring provinces also.

PROBLEMS FOR INVESTIGATION.

Custard-apple.

1. Classification of local varieties.
2. Selection of types.
3. Propagation of improved varieties from different parts of India, with a view to compare them with the best of the local ones.
4. Selection of the best varieties for commercial purposes.
5. Study of different methods of propagation with a view to evolve seedless varieties.
6. Study of different methods of utilisation of the surplus produce, for instance, drying, manufacture of flour from the pulp.

Grapes.

1. Classification of local varieties.
2. Selection of types.
3. Propagation of imported improved varieties, with a view to compare them with the best of the local ones.
4. Selection of the best varieties for commercial purposes.
5. Study of the proper time for pruning, with a view to adjust the fruiting to the season and the market.
6. Study of different methods of trellicing.

Pine-apples.

1. Classification of local varieties.
2. Selection of types.
3. Propagation of improved imported varieties with a view to compare them with the best of the local ones.
4. Selection of the best varieties for commercial purposes.
5. Experimenting with different methods of planting, in the open as well as in shade under trees.

General.

1. Trial of different catch crops, with a view to reduce the running cost of the orchards.
2. Studies with reference to all the above fruits of problems of tillage, drainage, manuring, irrigation, weathering, thinning, pruning, training and control of the insect pests and diseases.

Finance.

The budget estimate is given in the following. The total cost of the scheme amounts to Rs. 20,550 non-recurring and Rs. 52,140 recurring, spread over five years. The Hyderabad State will contribute Rs. 10,000 non-recurring and Rs. 4,080 recurring. The actual amount required from the Council is Rs. 10,550 non-recurring and Rs. 48,060 recurring, *i.e.*, a total of Rs. 58,610 in five years. It is not possible for the State to provide any more money, owing to the general financial stringency. The State will, however, lend the services of its Horticulturist for supervision of the execution of the scheme and of its Botanical, Chemical and Entomological sections for work in connection with the same. The receipts on account of the produce of the garden will be credited to the Council.

BUDGET ESTIMATE.

Non-recurring.

	Rs.
1. Land 25 acres @ Rs. 150 per acre*	3,750
2. Laying out plots and channels	1,000
3. Fencing	2,000
4. Bullocks, 3 pairs @ Rs. 250 per pair	750
5. Implements and tools	1,000
6. Pump and oil-engine	1,500
7. Deepening and repairing wells	1,500
8. Oil-engine shed	500
9. Shed for potting, grafting and packing	1,000
10. Implement and cart-shed	800
11. Office and store*	1,750
12. Superintendent's quarters*	3,500
13. Quarters for Malis, coolies, etc.*	1,000
14. Furniture for office and packing shed	500
Total	20,550

*To be provided by the Hyderabad State :—

	Rs.
1. Land	3,750
2. Office and store	1,750
3. Superintendent's quarters	3,500
4. Quarters for Malis, etc.	1,000

Total contribution of the State .. 10,000

Actual amount required from the Council .. 10,550

Recurring.

Particulars.	Amount in rupees.					
	I year.	II year.	III year.	IV year.	V year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. Superintendent at Rs. 250— 15—310 P. M.	3,000	3,180	3,360	3,540	3,720	16,800
2. Assistant at Rs. 110—5— 130 P. M.	1,320	1,380	1,440	1,500	1,560	7,200
3. Head Gardener at Rs. 60—4 —76 P. M.*	720	768	816	864	912	4,080
4. Clerk at Rs. 30—2—38 P. M.	360	384	408	432	456	2,040
5. Peon at Rs. 12 P. M. ..	144	144	144	144	144	720
6. Malis 3 at Rs. 15 P. M. each	540	540	540	540	540	2,700
7. Travelling allowance ..	600	600	600	600	600	3,000
8. Working charges (labour, seed, manure, cattle-food, etc.)	3,000	3,000	3,000	3,000	3,000	15,000
9. Office contingencies ..	120	120	120	120	120	600
Total ..	9,804	10,116	10,428	10,740	11,052	52,140
*Deduct on account of Head Gardener to be provided by the State.	720	768	816	864	912	4,080
Actual amount required from the Council.	9,084	9,348	9,612	9,876	10,140	48,060

(Sd.) NIZAMUDDIN HYDER,

*Director of Agriculture,**H. E. H. the Nizam's Government,**Hyderabad-Deccan.*

APPENDIX XLV.

NOTE, DATED THE 18TH AUGUST 1934, ON SUBJECT NO. 40. APPLICATION FROM THE GOVERNMENT OF MYSORE FOR A GRANT OF RS. 88,880 SPREAD OVER A PERIOD OF FIVE YEARS FOR A SCHEME FOR FRUIT CULTIVATION IN THE MYSORE STATE.

Attention is invited to the attached letter (Annexure I) from the Government of Mysore, No. D.-379/A.K.-153-33-11, dated the 20th July 1934, forwarding the scheme mentioned above. The scheme involves so far as the Council is concerned a total recurring expenditure of Rs. 88,880 spread over a period of five years.

2. The Vice-Chairman considers that it will be of advantage to have the scheme examined in the first instance by the Fruit Sub-Committee consisting of :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman (*ex-officio*).
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. The Director of Agriculture, Madras.
4. The Director of Agriculture, Bombay.
5. The Director of Agriculture, Bengal.
6. The Director of Agriculture, United Provinces.
7. The Director of Agriculture, Punjab.
8. The Director of Agriculture, Bihar and Orissa.
9. The Director of Agriculture, Central Provinces.
10. The Director of Agriculture, Assam.
11. The Director of Agriculture, North-West Frontier Province.
12. The Director of Agriculture, Hyderabad.
13. The Director of Agriculture, Mysore.
14. The Director of Agriculture, Baroda.
15. The Chief Publicity Officer, Indian State Railways.
16. The Agricultural Officer, Baluchistan.
17. The Secretary, Imperial Council of Agricultural Research, Secretary (*ex-officio*).

3. As the Committee and the Advisory Board will best consider to what extent, if any, this scheme overlaps others, a table is attached (Annexure II) summarising the work covered by schemes already sanctioned so far as this discussion is concerned.

4. The Committee will meet on some convenient afternoon between the 3rd and the 8th September 1934. Its report will be circulated to the Advisory Board in due course.

ANNEXURE I.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF HIS HIGHNESS THE MAHARAJA OF MYSORE, DEVELOPMENT DEPARTMENT, BANGALORE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. D.-379/A.K.-153-33-11, DATED THE 20TH JULY 1934.

With reference to your letter No. F. 6 (1)/34/G., dated 11th May 1934, regarding the tenth meeting of the Advisory Board of the Imperial Council of Agricultural Research, I am directed to forward herewith a scheme for fruit cultivation in the Mysore State with one hundred printed spare copies and to request that the scheme may kindly be placed before the Advisory Board for consideration.

ANNEXURE II.

Summary of investigations on fruits already included in existing schemes and programmes.

Name of fruit.	Details of investigations.	Names of provinces concerned.
Mango ..	Experiments in stocks	Madras and Bihar and Orissa.
	Varietal tests	Madras and Bihar and Orissa.
	Manurial experiments	Madras and Bihar and Orissa.
	Experiments in irrigation	Madras and Bihar and Orissa.
	Experiments in pruning and thinning ..	Bihar and Orissa.
	Pollination studies	Bihar and Orissa.
	Breeding of new varieties	United Provinces (Plains).
Citrus ..	Experiments in stocks	Madras, United Provinces (Plains), Punjab and Central Provinces.
	Varietal tests	Madras, United Provinces (Plains) and Central Provinces.
	Manurial experiments	Madras, United Provinces (Plains), Central Provinces and Assam.
	Breeding new varieties	Nil.

Name of fruit.	Details of investigations.	Names of provinces concerned.
Citrus— <i>contd.</i>	Pollination studies	Assam, Central Provinces and Punjab.
	Experiments in irrigation	Madras, Assam and Central Provinces.
	Experiments in pruning and thinning ..	Central Provinces.
	Varietal tests of other Citrus kinds ..	Assam.
Apples ..	Introduction of new varieties	United Provinces.
	Experiments in stocks	United Provinces (Hills).
	Varietal Tests	United Provinces (Hills).
	Pollination studies	United Provinces (Hills).
Grape vines ..	Experiments in stocks	Punjab.
	Varietal tests	Punjab.
	Pests and diseases	All Provinces.
	Grading, Packing and Marketing ..	(a) <i>Mangoes</i> .—United Provinces and Bombay. <i>Hill fruits</i> .—United Provinces, North-West Frontier Province and Baluchistan. (b) Progress must largely depend on the marketing survey.

ENCLOSURE TO ANNEXURE I.

DEPARTMENT OF HORTICULTURE.

MYSORE STATE.

A SCHEME FOR RESEARCH IN FRUIT CULTIVATION IN THE STATE.

PART I.

INTRODUCTION.

The following introductory note explains the conditions in the Mysore State which have to be considered in connection with the Scheme for Research in Fruit Cultivation which is dealt with in Part II of the note.

NATURAL CONDITIONS.

1. *Situation*.—The Mysore State is situated in South India between the eastern and western ghats. It is a plateau lying between 13.6' and 15.2' North latitude and 74.38' and 78.36' East longitude. The sea is at a distance of about eight miles from the farthest point from the State

on the west, about 120 miles on the east and about 250 miles on the south.

2. *Area*.—Mysore has an area of nearly 19,000,000 acres or 30,000 square miles. There are over 7,000,000 acres under cultivation out of which over 1,100,000 of acres are under irrigation (Canal irrigation, 165,307 acres, tank irrigation, 577,364 acres; well irrigation, 92,681 acres; and other sources, 296,590 acres).

3. *Natural Divisions*.—The country is naturally divided into two regions of unequal area. The smaller part consists of the hill country on the west and is called "Malnad" meaning the country of the hills, and the larger area on the east is called "Maidan" or the plains. The former covers the major portion of Hassan, Kadur, and Shimoga districts, and contains magnificent hills and forests and receives heavy rainfall in the south-west monsoon. The latter covers Bangalore, Kolar, Tumkur, Chitaldrug and Mysore districts. This division of Mysore into "Malnad" and "Maidan" by district units is not however quite correct. Parts of Mysore District are just as much Malnad as the rainy tracts of the three districts described by that name; and in these three districts themselves a considerable area is really Maidan, sharing neither the rain nor the forest and hill of the Malnad area. In the true Malnad a very small part of the whole area is cultivable. The Maidan country receives only a small fraction of the rain of the south-west monsoon supplemented by a still smaller fraction of the north-east monsoon. There is no high forest here and a great part of the land is cultivated. The soil is generally fertile and except in one belt of the country in the north-east, the rainfall, though not heavy, is still sufficient to support crops on fields and trees in the open country. The water received in the rains is stored in tanks in valleys in the plains to support wet and garden cultivation.

4. *Elevation*.—The general elevation of the country above the sea level is from 2,000 to 3,000 feet, the lowest point being in Chitaldrug district and the highest in Kadur district.

5. *Climate*.—The climate of Mysore is mild and equable. The year is divided into three seasons, namely Rainy season (from June to November), Cold season (from December to February), and Hot season (from March to May). The mean temperature in the warmest month ranges from 83°F to 87°F and in the coldest month from 62°F to 67°F. The temperature during the day rarely exceeds 100°F during the hottest part of the year and it has fallen below 50°F in very few winter nights. The atmosphere is neither very humid nor very dry, the mean value of the relative humidity in the wettest and the driest months being 86 and 63 per cent. respectively.

6. *Rainfall*.—Mysore enjoys the benefits of both the monsoons, the south-west and the north-east, the first opening usually in June and the second in October.

In the Maidan region the mean annual rainfall is 24 to 31 inches spread over 49 to 58 days and over half of the annual average falls in the months of August, September and October; from December to March little or no rain is gauged, the total for these months being only one inch.

The Malnad is the wettest part of the State having an annual normal rainfall of 73 to 100 inches falling on an average on 89 days,
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though in portions of Koppa and Mudigere the annual rainfall is as much as 300 inches. Heavy and practically continuous rainfalls from June to September and nearly one-third of the annual rainfall is recorded in July. The districts stand in the following order according to their rainfall. (1) Kadir 78 inches, (2) Shimoga 64 inches, (3) Hassan 48 inches, (4) Kolar 31 inches, (5) Bangalore 30 inches, (6) Mysore 29 inches, (7) Tumkur 27 inches, (8) Chitaldrug 26 inches.

7. *Soil*.—The soils of Mysore vary from black cotton clay to light sandy loam, the main type of soil being deep red loam which is well suited for the cultivation of many kinds of fruit trees.

The ideal climatic conditions favourable for general fruit culture are :—(1) Freedom from extremes of low and high temperature, (2) an abundance of sunshine and (3) Summer atmosphere with a low percentage of humidity. These conditions exist in many parts of the Maidan districts where fruit plants like Apples, Peaches, Grape vines, Mangoes, Guavas, Pomegranates and Figs grow well. In the Malnad districts where there is heavy rainfall and humidity in the air Citrus fruits, Bananas and Pineapples grow.

Fruits and vegetables, both indigenous and foreign, generally do better on the Mysore plateau than in most other parts of India.

ARTIFICIAL CONDITIONS.

The following facilities for the development of Fruit Culture are available :—

1. A Government Department which has dealt with Fruit Culture for over a century and which gives help and advice to orchardists.
2. Government help with Fruit Loans.
3. Cheap Electric Power for pumping installation and service by the Government Electric Department.
4. Transport facility. Important centres are connected by rail and road with other parts in and outside the State.
5. Marketing facilities.
6. Skilled Labour.
7. Private enterprise, as can be seen from the large number of orchards opened in recent years.

As early as in 1856, Hugh Cleghorn, Conservator of Forests, Madras Presidency, recommended Bangalore as the most suitable place for Horticultural experiments. In his report dated 30th August 1856 to the Madras Government, he states as follows :—

“ There can be no doubt that the climate is highly favourable and the soil capable of producing the best description of many vegetable products. Bangalore is much better suited for Agricultural and Horticultural experiments than either Ootacamund or Madras and from its central position and intermediate elevation the finer kinds of vegetables and better sorts of graft trees may be disseminated with great success to the neighbouring ranges of hills such as Bababudans, Ramanmalai, Shevarai and Palnis.”

The climate of Bangalore which is most centrally situated is sub-tropical as compared with the tropical climate of Madras and the distinctly temperate condition of the Nilgiris, and practically all kinds of fruit plants growing in temperate climates can be grown here, besides almost all the sub-tropical and tropical fruits.

BRIEF HISTORY OF DEPARTMENTAL WORK.

Horticulture received much impetus after the establishment of the Agri-Horticultural Society at Bangalore in 1836, nearly a century ago, but more especially after the formation of the Lal-Bagh as Horticultural and Botanical gardens in 1856 after the Society ceased to exist. A profitable means of livelihood was opened to local gardeners some of whom have set up as Florists and Seedsmen and have been doing good business for many years.

With the limited funds at the disposal of the Department, it has done work in the trial of fruit plants, their propagation and distribution in many places.

A list of fruit trees introduced by this Department since 1860 is attached to the Note. In 1897, the outbreak of the American Blight or Woolly Aphis caused considerable loss to apple growers and many varieties which were under trial and cultivation were destroyed by this pest. The Department revived the cultivation of apples since the year 1914 by the importation of new varieties grafted on disease resisting stock from Australia. About 100,000 of Australian fruit plants were distributed during the past seven years. Altogether over 200,000 of plants have been supplied to private orchardists. A Fumigatorium was constructed at Lal-Bagh to fumigate the incoming and outgoing plants, and the Government of India have exempted the Superintendent of Government Gardens, from getting imported plants fumigated at the ports of entry. The Government of His Highness the Maharaja of Mysore have sanctioned the free supply of fruit plants raised by the Horticultural Department to raiyats for being planted in their backyards and a Spraying Staff to demonstrate the methods of treating various plant diseases and pests. Many private growers are now adopting improved methods of cultivation and attend to the systematic spraying of plants.

Further impetus was given to Fruit Culture by the Mysore Economic Conference and a survey of Fruit Cultivation in the Mysore State was done through the agency of this Department which suggested the opening of an Experimental Orchard, a Fruit Nursery and an Horticultural School and the appointment of Horticultural Inspectors. The School was opened and the Horticultural Inspectors worked for some years, but later the School had to be closed and the number of Inspectors reduced from eight to three on account of financial stringency.

In recent years electric power is being supplied at cheap rates and pumping installations are put up for raiyats by the Electric Department, the cost being recovered in small instalments. A Scheme for the grant of Fruit Culture loans, somewhat on the lines of Takavi Loans has also been under operation for many years. With these facilities and with the help and advice given by this Department a number of gardens are springing up.

Exports and Imports.—The statistics available are not very accurate but the following figures give an idea of the extent of the industry.

There are about 200,000 acres under fruit and vegetables. There is a fairly large export trade to Madras, Bombay and Hyderabad. The total exports of Mangoes, Grapes, Oranges, etc., in the year 1930-31, amounted to 4,96,506, maunds valued at Rs. 52,34,313 while the imports amounted to 2,57,412 maunds valued at Rs. 27,02,826.

FRUIT CULTURE IN MYSORE AND SCOPE FOR ITS EXTENSION.

The Mysore State is well-known for its Apples, Citrus Fruits, Mangoes, Figs, Plantains, Pomegranates, Guavas, and Papayas.

1. *Apples*.—This is one of the important fruits grown commercially at Bangalore and there is great scope for its extension. Rome Beauty, Cox's Orange Pippin, Jonathan and Cleopatra varieties have been found to do well here. There is hardly any crop which is as profitable here as the Rome Beauty Apple. The Horticultural Department alone has distributed 100,000 of Apple plants to growers. Besides these private nurseries have sold a large number. The growers have also raised grafts in their orchards. The average net income is Rs. 1,000 per acre from two crops in the year. Some crops have fetched Rs. 4,000 to Rs. 6,000 per acre. The Horticultural Department has imported five varieties of vigorous growing Apple Stocks (vegetatively propagated) from East Malling Research Station, England. These will be tried under Stock experiments.

2. *Citrus Fruits*.—Citrus fruits are grown in Kadur, Hassan and Bangalore Districts. The famous "Loose Jacket" oranges grown at Yemmai Doodi in Kadur District are exported outside the State. Lime is largely grown in Bangalore District and each tree produces about 1,000 fruits yearly on the average, giving an income of Rs. 5 per tree. The Pumelo can be grown easily but the delicious variety is almost a rarity. The finest fruits are grown in Devanhalli in Bangalore District, a tree producing about 200 fruits and each fruit being sold at As. 8 to Re. 1. Our markets import large quantities of Citrus fruits such as Mozambique oranges from Bombay, Nagpur oranges from Nagpur and Grape fruits, Lemons, and Washington Navel Oranges from South Africa, California and Australia.

Imported varieties of Oranges such as Washington Navel and Valencia Late are grown by some enterprising orchardists successfully around Bangalore. These plants were first imported from Australia and tried by this Department and then plants were supplied to fruit growers to whom the methods of growing were demonstrated. There is a great scope for their extension and a good export trade can be built, and the dumping of the South African, Australian and American fruits into the Indian market can be checked.

3. *Grapes*.—At present this fruit, a black variety, is grown in small patches chiefly round about Bangalore. Though the quality is inferior to that of imported Grapes, a considerable quantity of this fruit is exported. The income derived from each vine is from Rs. 10 to Rs. 30 from two crops in the year. Superior varieties such as Muscat of Alexandria, Black Hamburg, Dodrelabi, etc., are grown chiefly in the Government and Palace gardens. There is a great scope for the introduction of new varieties in many parts of the State. In certain seasons Kabul grapes are largely imported now.

4. *Mangoes*.—Particular areas in certain districts are well-known for the superior quality of mangoes, for example, Seringapatam for Badami, and Tumkur and Bangalore for Rasputri fruits. Neelum from Chittoor, Mulgoa from Salem and Alphonso from Bombay and Jehangir from Andhra Districts in Madras Presidency are imported. The area under Mango is over 15,000 acres in the State. About 100 varieties of Mango plants have been imported from different parts of India and are being grown in Bangalore.

5. *Figs*.—The cultivation of Figs is confined to some parts of Bangalore and Seringapatam. There is scope for its extension in other dry districts.

6. *Plantains*.—The State imports large quantity of plantains valued to the extent of over ten lakhs of rupees. Though the Nanjangud "Rasabale" and the Bangalore "Rajabale" are famous, yet the quantity grown is very limited. Banana is one of the easiest grown fruits and the area under it should be increased, so that even the poor people may have fruit in their diet.

7. *Pomegranates*.—Though this fruit can be grown in many places, the cultivation of good varieties is confined to few localities such as Chintamani in Kolar District, Madhugiri in Tumkur District, and Jaganahalli in Bangalore District. Each tree yields 100 to 200 fruits, large in size and beautiful in colour, and the fruits sell at four to eight annas each.

8. *Guavos*.—This fruit plant thrives in almost any soil and requires no great care in its cultivation. Local varieties are grown all over. A superior variety from Allahabad has been introduced and its cultivation around Bangalore is spreading widely.

9. *Custard Apple*.—This plant which can be grown even in arid and rocky areas where few other fruit trees would thrive, is a useful one. The Cherimoyer (*Anona Cherimolia*) which grows on higher elevations has yet to be tried. Five varieties are being grown in the Government Botanic Gardens at Bangalore.

10. *Papayas*.—There is a good deal of scope for its cultivation all over the State. Seeds of superior varieties are being distributed by this Department. Papaya flourishes almost anywhere except in water-logged areas and yields fruit within a year. Large areas may be planted for extracting juice for the preparation of papain.

11. *Pineapple*.—Though this fruit could be successfully grown all over the State, yet fruits are being imported from Travancore and Singapore. Some growers are successfully cultivating the Queen Pineapple which has the finest flavour in Bangalore district. Five new varieties are under trial in the Government Botanic Gardens, Bangalore. Pineapple is found to be a good source of iron, copper and manganese and it is considered to be a cure against Pyorrhœa, dental decay and Beri-beri disease.

12. *Jak*.—The Jak is abundant in Malnad and the cultivation of good types might be extended. There are good, bad and indifferent fruits, and seeds from only good fruits should be selected for propagation. This is being done on a small scale in the Government Botanic Gardens, Bangalore.

13. *Sapota or Sapodilla*.—Though this is one of the tropical fruits, it is hardly known to the public in the State. This tree is successfully grown in the Government Botanic Gardens and in the Palace Gardens in Bangalore. It is popular in Bengal and in Telugu districts of the Madras Presidency. It is easy to grow. Good varieties have to be imported and their cultivation popularised.

14. Other fruit plants which are grown in the Botanic Gardens and which are being spread into the districts are Loquat, Butter fruit, Raspberry, Strawberry, Brazilian cherry and Litchi.

PART II.

FRUIT RESEARCH SCHEME.

The natural and artificial conditions favourable for fruit cultivation in Mysore State, the present position of indigenous and imported fruit trees and the scope for the extension of their cultivation and the progress of work in the introduction and development of fruit plants in the Horticultural Department of the State have been dealt with in the introductory note. While a good deal of work has been done in fruit culture in the past, it is a painful fact that the work could not be done in a systematic manner for want of an experimental orchard equipped with necessary men and materials for conducting experiments and noting the results. The scheme could not be taken up on account of financial stringency during recent years. It is admitted that both natural and artificial conditions for fruit cultivation are available in the State; it is admitted that fruit cultivation is a very profitable industry, provided the grower has got correct knowledge of the work; and it is further admitted that fruit is an important article of diet and that adequate quantity is not consumed in our daily food. Taking all these facts into consideration, the logical conclusion would be that every possible attention to the development of the fruit industry on sound and systematic lines should be paid. This however cannot be done unless there is an experimental orchard equipped with the necessary buildings and machinery and suitable staff, as the problems to be tackled, in connection with fruit cultivation, are numerous. Although much spade work has been done in the past, yet it has so far not been possible to take up the work seriously on a large scale on a permanent basis. The time has now come for undertaking it on systematic lines in right earnest with the financial assistance of the Imperial Council of Agricultural Research. As it has already been said that Mysore has suitable soil and climatic conditions for cultivation of fruits, both indigenous and foreign, it is proposed to begin research work on Apples, Oranges, Grapes and Mangoes, fruit crops of All-India importance in the first instance. The contribution from the Imperial Council of Agricultural Research for the development of fruit cultivation would, therefore, be useful not only to Mysore but to the whole of India, while the value of the work done will be of world-wide importance.

The main objects of the orchard would be :—

1. To introduce superior varieties.
2. To conduct various experiments connected with Fruit Culture as explained in detail later on.

3. To spread knowledge of names and characters of various kinds and varieties suitable for different local conditions.
4. To serve as a training ground for students of Horticulture and also for arranging Short Courses to private people in planting, pruning, spraying, grafting, etc.

SITUATION OF THE EXPERIMENTAL ORCHARD.

The experimental orchard should be located in an easily accessible spot in a district where fruit growing is already in existence so that the benefits of the station be readily taken advantage of by fruit growers. Bangalore which is conveniently situated in South India is undoubtedly the best place. It is already a large fruit growing district and the number of kinds of fruit trees, both tropical and sub-tropical, which can be successfully grown is larger here than in other districts. It is the only centre where there are private commercial nurseries and orchards. There is scope for the cultivation of different kinds of fruit plants requiring different situations and soil conditions. There is trained labour available. It is the headquarters of the Horticultural Department which has dealt with fruit work for a century and which has already opened a small fruit nursery. It is also the headquarters of other Departments, such as Agricultural, Co-operative, Industrial and Forest, while the Indian Institute of Science is also situated here.

TECHNICAL ASPECT.

The foremost necessity is an intensive study of the fruits, such as Apples, Grapes, Oranges and Mangoes which are of All-India importance and which are largely exported. It is, therefore, proposed to begin work on these fruit crops. There is also a vast field for the introduction of new varieties of fruits, such as Butter fruit, Allahabad Guavas, Pine-apple, Litchi, Sapodilla, etc., which may be grown to demonstrate the possibility of easy cultivation of these fruits. Again a great number of plants are imported from Australia, but the cost is high and the stocks are not suitable in all cases, while plants locally raised are often inferior. So the supply at low cost of fruit trees suitable to different localities is a pressing need. To attain these objects, the following important problems have to be taken up for investigation : (1) Selection of suitable stocks and studying their influence on different scions, (2) Introduction of new varieties, (3) Experiments in the different methods of propagation, (4) Manurial experiments, (5) Study of plant pests and diseases and finding out effective remedies (this problem would be studied in the experimental as well as local orchards, the immediate problems for consideration being investigation into the Collar-rot disease of apples, and the Yellowing and Die-back diseases of Citrus plants), (6) Experiments in planting distances, irrigation, and pruning, (7) Study of flowering of plants in relation to climatic conditions, (8) Marketing problems, (9) Utilisation of surplus fruits, and (10) Maintenance of proper crop records. The problems to be taken up for investigation in the Fruit Experiment Station are dealt with below in detail :—

1. *Stocks*.—This is a very important section in the work concerning the development of fruit culture. Most of the budded or grafted trees are at present being raised in Bangalore round about the Botanic Gardens, particularly in Siddapur village. The Nurserymen have not studied the

suitability of the various stocks. The Gardens Department has imported five varieties of Apple stocks, propagated vegetatively, from East Malling Research Station. Similarly, other stock plants should be imported, and also local stocks which, in some cases, are very good should be collected and studied, keeping in view their powers of resisting diseases and their suitability for different kinds of soils.

2. (a) *Introduction of New Varieties for trial*.—The average private grower cannot obviously undertake this work. A large number of varieties have to be introduced from different parts of the world and tried under local conditions and those that prove successful should be propagated and distributed. There is a great scope for the introduction of new varieties of Oranges, Apples, Grape vines, Pine-apples, etc., and this work is very important in the development of fruit culture. Correct records of the yields and the quality and other characters of each individual plant will, of course, be maintained which ought to prove of great value not only in assessing the nature of each plant and variety but also for purpose of deeding which to propagate with advantage.

(b) *Pollination and Fertilisation*.—It is not generally understood that certain varieties of fruit plants such as Apples yield larger crops when fertilised by other varieties. This is a problem about which very little is known in India, and it is of great importance that very careful experiments should be conducted with a view to obtain knowledge on the subject.

3. *Propagation of plants*.—To obtain reliable plants true to type vegetative propagation is necessary. Though grafting and budding is practised locally, budding is not being largely adopted. The best method of vegetative propagation required for each kind of tree has to be investigated. It has to be ascertained whether or not the System practised in Europe of dwarfing the trees, by grafting on stocks of different allied species, might not answer well here. The advantages are that the plants bear early and they take little room. It is necessary that fruit growers should plant recognised varieties to get profitable crops. Mixing varieties is not desirable in a commercial orchard except to the extent that it is necessary for pollination.

Work on the vegetative propagation of several indigenous fruit trees which are now generally raised by seed has also to be undertaken.

4. *Breeding of New Varieties*.—In addition to the above, breeding work on a few of the important fruits like Apples, Oranges, and Mangoes will be undertaken by the raising of the seedling plants and by cross fertilisation. Trial and selection work on these seedlings will follow and will be based on the performance record of these seedlings in respect to all desirable characteristics including disease resistance. Propagation by the best strains will next be undertaken both for the Station and for the supply of plants to private growers. Very important and strikingly superior varieties of several fruits have thus been originated in western countries and results of a similar character may be expected from this work on this Station also. The main object of seedling trial would be to raise a number of seedlings quickly and to select varieties which would show outstanding characters or would show their suitability for use as parents. The breeding work will also give clue for the selection of stocks and scions useful for vegetative propagation.

5. *Manuring*.—Sheep manure is chiefly applied to most of the fruit trees. It is difficult to obtain it in large quantities and the little that can be had is sold at prohibitive prices. Experiments should be conducted to see what manures and in what quantities they are most effective and economical.

6. *Insect Pests and Fungus Diseases*.—Insect Pests are responsible for heavy losses in orchards in all parts of the world and the Mysore plateau is not an exception to this. Among the common pests mention may be made of Stem borers, Leaf-eating Caterpillars and Beetles, Scales, Green bug, Mealy bug, Plant lice, White ants and Fruit flies. Though the Government Gardens Department is paying special attention to the treatment of these pests with the help of a permanent Spraying Staff, yet a great deal of investigation has to be carried on to find suitable insecticides, sprayers and dusting machines worked by hand and power. Correct data regarding the cost of spraying economically has to be found out.

(b) *Fungus Diseases*.—The following are the important Fungus diseases that cause damage to fruit trees in the State. (1) Mildew, (2) Canker, (3) Root rot, (4) Collar-rot, (5) Leaf curls, (6) Fruit rot, (7) Die-back and (8) Crown gall. Work on the lines indicated in connection with the treatment of insect pests has to be carried on and the results made known to fruit growers.

The above mentioned six problems will be chiefly taken up for investigation in the Experimental Orchard. The following ones would be attended to as circumstances arise.

Planting Distances.—Reliable data of the distances required for each kind of plants to produce the maximum yield per acre without affecting the health of the plant has to be gathered, though certain knowledge obtained from observation of local orchards is already available.

Irrigation.—In localities where fruits grow well, water is not found in too large a quantity so that the right quantity of water required for each kind of fruit tree has to be found out. Over-irrigation is often the prevailing practice and it is one of the causes of the failure of orchards.

Pruning.—The method of pruning varies with each kind of fruit tree and often with each variety of a particular kind of tree. The Grape vine is the only fruit plant which receives a certain amount of pruning here. Other fruit trees are not systematically pruned. Investigations have to be done to see whether artificial wintering and whether defoliation of Apple plants as are practised in Bangalore influence the life of the plant.

Thinning of Fruits.—Fruits are not thinned by local growers. Thinning is necessary to get good sized fruits. The extent to which thinning is to be practised under local conditions has to be investigated and demonstrated.

Flowering in relation to Rainfall.—The flowering period of the same fruit plant varies according to the rainfall of a locality. Detailed observations have to be made about the periods of flowering of various fruit trees in order to give advice to the growers to raise early and late crops according to the requirements of the various markets.

Grading, Packing and Marketing of Fruits.—In countries such as the United States, Australia, and South Africa where fruit cultivation has advanced, fruits are graded into various sizes and scientifically packed and placed on the market in an attractive manner. Unless Indian fruits are treated in this manner, it is impossible to compete successfully with the imported fruits. Methods of packing and grading suitable to local conditions have to be evolved and demonstrated to fruit growers. Just recently, the Mysore Fruit Growers' Association has been formed and it is hoped that orchardists will be greatly benefited by their co-operative efforts.

Keeping Properties of Fruits.—Suitable fruits which will be able to travel long distances and at the same time possess good size, colour and flavour have to be evolved. In the consideration of finding suitable markets this work is of great value to fruit growers.

Preservation of Fruits.—Though the problem of preservation of fruits on a commercial scale is not an immediate one, as we are neither in a position to compete with foreign stuff nor to find a large market for them on account of certain disabilities about which it is not necessary to deal with here, yet a time will come when this has to be studied. For the present there is scope to study this question from a domestic point of view. A good deal of work in bottling of various kinds of fruits and fruit juices has been done by this Department. It is very useful to preserve fruits in their season for home consumption. The work already carried out should be extended and short courses arranged for the benefit of those who grow fruits.

Growing of Inter-crops in Young Orchards.—Orchards generally come to bearing in three to five years after planting trees. Till then, in many a case, the grower has to get an income to maintain himself and his orchard. Therefore, it would be necessary to grow inter-crops, such as, vegetables which will not interfere with the growth of the fruit trees. Investigation has to be taken up to find out the most suitable crops to grow among the various kinds of fruit trees.

Crop Records.—Definite knowledge is lacking regarding the fruiting capacity of different varieties of fruits both indigenous and foreign. It is therefore very necessary to maintain proper crop records of each tree to note the quantity and the quality of the yield and also records of the prices obtained for the fruits for a period of years. These records together with those of the keeping quality will enable us to pick out good varieties and then good trees from which to propagate plants for distribution to fruit growers.

The details of the Experiments are stated below :—

DETAILS OF AREA.

I. Apples :—(15 acres)—

1. Experiments in Stocks (10 stocks grafted on two important varieties).
2. Varietal tests (100 varieties).
3. Manurial Experiments.
4. Experiments in Irrigation.
5. Experiments in Pruning and Thinning.
6. Pollination Experiments.

II. *Grape Vines* :—(8 acres)—

1. Varietal tests (25 varieties).
2. Manurial Experiments.
3. Experiments in Training, Pruning and Thinning.
4. Experiments in Stocks.

III. *Citrus Fruits* :—(30 acres)—

1. Experiments in Stocks (10 stocks grafted on 5 important varieties).
2. Varietal tests (25 varieties).
3. Manurial Experiments.
4. Seedling trials.
5. Experiments in Irrigation.
6. Varietal tests of other Citrus kinds (30 varieties).

IV. *Mangoes* :—(30 acres)—

1. Experiments in Stocks (5 stocks grafted on two important varieties).
2. Varietal tests (150 varieties).
3. Seedling trials.

V. *Miscellaneous Fruit Plot* :—(17 acres)—

Thus 100 acres will be taken up by the Experimental plots and an area of 50 acres will be required for pastures, roads, etc., so that the total extent of the Research Station will be 150 acres.

FINANCIAL ASPECT.

The value of the contribution of the Government of Mysore for the Research Scheme would be Rs. 95,000 on account of lands, buildings, pumps, fencing, construction of storage tanks, etc., under non-recurring items and maintenance of roads and buildings and the supply of electric power under recurring items as per details given in Appendix A.

The Imperial Council of Agricultural Research is requested to sanction a sum of Rs. 88,880 in instalments distributed over five years. It is hoped that after five years the Orchard would be self-supporting. The income derived from the crops would be utilised for the development of the fruit industry.

The details of Expenditure are given in Appendices A, B and C.

H. C. JAVARAYA,

Superintendent,

Government Gardens in Mysore.

APPENDIX A.

Estimate of Cost to be met by the Government of Mysore.

NON-RECURRING CHARGES.

No.	Particulars.	Amount in rupees.
		Rs.
1	Land	15,000
2	Buildings—	
	Farm Manager's Quarters (1)	5,000
	Assistant Farm Manager's Quarters (1)	3,000
	Quarters for Other Officials	8,000
	Block for Menial Staff	8,000
	Cattle Shed	1,000
	Potting and Grafting Shed	1,000
	Implements and Cart Shed	1,000
	Office and Stores	8,000
	Laboratory	10,000
	Laboratory equipment	5,000
3	Other Items—	
	1. Fencing	6,000
	2. Formation of Drains, Roads, etc.	3,000
	3. Storage tanks	4,000
	4. Pumps with pipe connections	6,000
	5. Bullocks four pairs	1,000
	Total ..	85,000

RECURRING CHARGES.

No.	Particulars.	Amount in rupees.					Total.
		1st year.	2nd year.	3rd year.	4th year.	5th year.	
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1	Maintenance of Roads and Buildings. ..	..	..	..	1,000	1,000	2,000
2	Electric Power ..	500	750	750	1,000	1,000	4,000
3	Unforeseen Charges ..	1,000	1,000	1,000	500	500	4,000
	Total ..	1,500	1,750	1,750	2,500	2,500	10,000
	Grand Total ..	..	..	..	..	..	95,000

APPENDIX B.

Estimate of Cost to be met by the Imperial Council of Agricultural Research.

RECURRING CHARGES.

No.	Particulars.	Amount in rupees.					Total.
		1st year.	2nd year.	3rd year.	4th year.	5th year.	
1	Staff—	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
	Farm Manager 1 (100—10—150).	1,200	1,320	1,440	1,560	1,680	7,200
	Assistant Farm Manager 1 (50—5—75).	..	..	..	600	660	1,260
	Foreman	480	480	900	1,260	1,560	4,680
		(One Foreman.)	(One Foreman.)	(Two Foremen.)	(Three Foremen.)	(Four Foremen.)	
	Plant Propagator 1 (50—5—75).	600	660	720	780	840	3,600
	Assistant Entomologist 1 (100).	1,200	1,200	1,200	1,200	1,200	6,000
	Assistant Mycologist 1 (100).	1,200	1,200	1,200	1,200	1,200	6,000
	Laboratory Attendants 2 (20.)	480	480	480	480	480	2,400
	Accounts Clerk 1 (35—5—60).	420	480	540	600	660	2,700
	Typist and Record-keeper 1 : 30.	360	360	360	360	360	1,800
	Store-keeper 1 : 30 ..	360	360	360	360	360	1,800
	Peons 2 : 12	288	288	288	288	288	1,440
		6,588	6,828	7,488	8,688	9,288	38,880
2	Maintenance—						
	Labour	3,000	4,000	5,000	6,000	7,000	25,000
	Manure .. ..	..	1,000	3,000	3,000	3,000	10,000
	Plants and Seeds ..	1,000	2,000	1,000	1,000	1,000	6,000
	Tools and Implements	1,000	1,000	500	500	1,000	4,000
	Contingencies ..	1,000	1,000	1,000	1,000	1,000	5,000
	Total ..	6,000	9,000	10,500	11,500	13,000	50,000
	Grand Total ..	..	..	..	..	..	88,880

APPENDIX C.
ABSTRACT OF EXPENDITURE.

Particulars.	Amount in rupees.					Total.
	1st year.	2nd year.	3rd year.	4th year.	5th year.	
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Government of Mysore—						
Total Non-Recurring ..	85,000	..	..	..	..	85,000
Total Recurring ..	1,500	1,750	1,750	2,500	2,500	10,000
	..	..	..	..	..	95,000
Imperial Council of Agricultural Research—						
Total Recurring ..	12,588	15,828	17,988	20,188	22,288	88,880
Grand Total ..	..	..	..	..	..	183,880

List of Fruit trees introduced by the Gardens Department since 1860.

APPLES.

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Rome Beauty. 2. Cox's Orange Pippin. 3. Jonathan. 4. Reinette du Canada. 5. Cleopatra. 6. Allington Pippin. 7. King David. 8. Devonshire Quarrenden. 9. Ribston Pippin. 10. Worcester Pearmain. 11. Kentish Fill Basket. 12. Glengyle Red. 13. London Pippin. 14. Wilson Red June. 15. Munro's Favourite. 16. Emperor Alexander. 17. Granny Smith. 18. Delicious. 19. Albermarale Pippin. | <ol style="list-style-type: none"> 20. Rokewood. 21. Sturmer Pippin. 22. Lord Wolseley. 23. Pomme de Neige. 24. Marjorie Hay. 25. Stayman Winesap. 26. Gravenstein. 27. Statesman. 28. Red Statesman. 29. Williams' Favourite. 30. Dougherty. 31. Crofton Pearmain. 32. Lord Nelson. 33. Lady Carrington. 34. Henry Clay. 35. Loy. 36. Irish Peach. 37. Democrat. 38. Yates. 39. McIntosh Red. |
|--|--|

40. Black Ben Davies.
41. General Carrington.
42. Cole.
43. Foster.
44. Commeree.
45. Elsie Grant.
46. Senator.
47. Liveland Raspberry.
48. Beauty of Bath.
49. Hoover.
50. Northern Spy.
51. Peasgood's Nonsuch.
52. Newton Pippin.
53. Springdale.
54. Esopus Spitzenberg.

GRAPES.

1. Dodrelabi.
2. Muscat of Alexandria.
3. Black Hamburg.
4. Gordo Blanco.
5. Doradilla.
6. Muscat Hamburg.
7. Black Prince.

CITRUS.

(a) *Orange*.—

1. Washington Navel.
2. Thompson's Improved navel.
3. Valencia Late.
4. Joppa.
5. Navelencia.
6. St. Michael.
7. Parametta.
8. Jaffa.
9. Queen.
10. Seville.
11. Mediterranean Sweet.
12. Nagapur.
13. Emperor (Mandarian).
14. Thorny (Mandarian).
15. Beauty of Glen. Retreat.
(Mandarian).

(b) *Lemon*.—

1. Eureka.
2. Lisbon.
3. Villa franca.
4. Sweet Rind.

(c) *Grape Fruit*.—

1. Marsh Seedless.
2. Triumph.
3. Shaddock Blood.

(d) *Limes*.—

1. Darjeeling Lime.
2. Tahitian.
3. Dominion Spineless.

STRAWBERRY.

1. Royal Sovereign.
2. Melba.
3. Illawarra.

APRICOT.

1. Moor Park.
2. Blenheim.
3. Early Moor Park.

PEACHES.

1. Early Rivers.
2. Elberta.
3. Triumph.

PLUM.

1. Diamond.
2. Greengage.
3. Jefferson.
4. Coe's Golden Drop.
5. Monarch.
6. Magnum Bonum Yellow.
7. Rivers Early Prolife.
8. Washington.
9. Burbank.
10. Kelsey.
11. Wicksen.

PEARS.

1. William's bon Chretien.
2. Jargonelle.
3. Keiffer's Hybrid.
4. Howell.
5. Wilder.
6. Paekham's Triumph.
7. Clapp's Favourite.
8. Doyenne du Comice.
9. Vicar of Winkfield.
10. Winter Bartlett.

PAPAYA.

1. Washington.
2. Ceylon.
3. Honey Dew.
4. Singapore.
5. Mammoth Java.

ANONAS.

1. Anona squamosa.
2. Anona reticulata.
3. Anona muricata.
4. Anona cherimolia.

PLANTAINS.

1. Rasabale.
2. Chandrabale.
3. Havubale.
4. Rajabale.
5. Yelakkibale.
6. Puttabale.
7. Karibale.
8. Madurangabale.
9. Kassadia.
10. Payan.
11. Savargundi.
12. Madura Annun.
13. Sahasrapalli.
14. Suganda.
15. Sohnaai.
16. Pacha Vellan.
17. Rastali.
18. Sonari.
19. Kumbica Annan.
20. Red.
21. Rageli.
22. Mutheli.
23. Lal-Velchi.
24. Bankel.
25. Safet Velchi.
26. Karanjeli.
27. Mhosket.
28. Govajiri.
29. Kanher.
30. Ruswell.
31. Meghone.
32. Noire.
33. Gaban.
34. Blane.
35. St. Pacques.
36. Malgache.

PINE APPLE.

1. Smooth Cayenne.
2. Mauritius.
3. Queen.
4. Kew Giant Pine.
5. West Indian.
6. Ripply Queen.
7. Singapore.

MANGO.

1. Banganapalli.
2. Jehangir.
3. Strawberry.
4. Bhurdas.
5. Kakaria.
6. Gopalbhog.
7. Khrishnabhog.
8. Langra.
9. Punia.
10. Kistapal.
11. Baramashi.
12. Fagri Round.
13. Sharbathi Brown.
14. Sharbathi Black.
15. Safaida.
16. Najibadi Amin.
17. Sundarshaw.
18. Nureka.
19. Nayab.
20. Surkha.
21. Sunahra.
22. Khajya.
23. Bulbalechasm.
24. Tamarancha.
25. Romani.
22. Lord Wolseley.
27. Kachmahua.
28. Khapariah.
29. Katna.
30. Pyasse.
31. Longra Hardoi.
32. Subbunda.

33. Arbuthnott.
34. Calamin.
35. Kala.
36. Naspati.
37. Madras.
38. Sunnerbahish.
39. Mossiroto.
40. Calacco.
41. Tonquie.
42. Carriera.
43. Costa.
44. Fermandario.
45. Madam.
46. Swango Hasipoor Longra.
47. Startskorts, No. 1.
48. Ferroghabonne.
49. Enmrrha.
50. Golerb Bhas.
51. Bombay.
52. Society, No. 1.
53. Society, No. 2.
54. Borumarhi.
55. Fusri.
56. Hatiyal.
57. Bhorta Bombay.

58. Stalkorts.
59. Bombay, No. 2.
60. Tamancha.
61. Decruse.
62. Kachee Meelat.
63. Dilpasand.
64. Mis. Horwoods.
65. Dewhallia.
66. Bealkhus.
67. Golarb Khas.
68. Maldah.
69. Kacha Meetarh.
70. Momberra.
71. Goa.
72. Khortohab Berna.
73. Augrahalli.
74. Amargola.
75. Peters.
76. Nashati.
77. Bengal, No. 1.
78. Bengal, No. 2.
79. Pyonee.
80. Superintendent Lahore.
81. Brumda Brones.
82. Bhordea.
83. Huma Bhuda.

APPENDIX XLV—A.

SUPPLEMENTARY NOTE, DATED THE 22ND AUGUST 1934, ON SUBJECT No. 40 ;
APPLICATION FROM THE GOVERNMENT OF MYSORE FOR A GRANT OF
RS. 88,880 SPREAD OVER A PERIOD OF FIVE YEARS FOR A SCHEME FOR
FRUIT CULTIVATION IN THE MYSORE STATE.

In continuation of the note, dated the 18th August 1934, on the above subject, (Appendix XLV), a copy of the undermentioned correspondence with the Government of Mysore containing further particulars relating to the scheme, is circulated for the information of the Advisory Board :—

- (1) Letter to the Government of Mysore, No. F. 241|34|Agri., dated the 8th August 1934.
- (2) Letter from the Government of Mysore, No. D.-1254|A. & E.-90-32-48, dated the 17th August 1934.

COPY OF LETTER FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO THE SECRETARY TO THE GOVERNMENT OF HIS HIGHNESS THE MAHARAJA OF MYSORE, DEVELOPMENT DEPARTMENT, No. F. 241|34|AGRI., DATED THE 8TH AUGUST 1934.

SUBJECT :—*Fruit Research Scheme, Mysore.*

I am directed to refer to your letter No. D.-379|A.K.-153-33-11, dated the 20th July 1934, forwarding a scheme for fruit cultivation in the Mysore State.

2. I am to say that the Scheme will first be placed before the Fruit Committee of the Imperial Council of Agricultural Research at the time of the meeting of the Advisory Board of the Council to be held from 3rd to 8th September 1934 and thereafter submitted to the Advisory Board together with the report of the Committee. In the meantime, I am to request that information on the following points may kindly be furnished to this Department for the use of the Committee and the Advisory Board :—

- (i) Whether all the charges shown in Appendix A of the Scheme represent new expenditure, which the Mysore Government is prepared to undertake, if the scheme is sanctioned ;
- (ii) An estimate of the anticipated receipts during the pendency of the Scheme may please be furnished ;
- (iii) Whether any part of the 100 acres of land to be reserved for the Scheme will be established orchard or whether it will all be for newly planted ;
- (iv) What qualifications are proposed for the Farm Manager and the Assistant Farm Manager ; and
- (v) What officer will be responsible for the technical control of the work and who will carry out the somewhat difficult breeding work, referred to in paragraph 4 (page 12 of the printed Scheme).

A very early reply is requested.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF HIS HIGHNESS THE MAHARAJA OF MYSORE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. D-1254/A. & E-90-32-48, DATED THE 17TH AUGUST 1934.

With reference to your letter No. F. 241/34/Agri., dated 8th August 1934, regarding the Fruit Research Scheme in Mysore, I am directed to furnish you the following information :—

(i) Appendix A includes two estimates—one for recurring and the other for non-recurring charges. The whole of the recurring charges amounting to Rs. 10,000 is obviously new expenditure.

The non-recurring charges of Rs. 85,000 include three items, *viz.*, Land, Buildings and Miscellaneous.

Lands required for the orchard are being provided by Government, but some portions may have to be acquired. The estimated value of all the lands is Rs. 15,000. In regard to buildings, it is proposed to use the building now available with necessary alterations and additions which is expected to cost Rs. 5,000. These buildings with the land on which they stand are conveniently situated for a factory, more especially as it is so close to Bangalore and water and power are easily available. In fact, a proposal to use the site and the buildings for locating a factory was under the consideration of Government but they are making them available for these investigations. Other items such as fencing, roads, tanks, etc., cost Rs. 20,000 and have to be newly provided.

In these circumstances, practically all the charges shown in Appendix A may be treated as new expenditure to be incurred by the Mysore Government.

(ii) The anticipated receipts during the pendency of the scheme would be about Rs. 3,000 as shown below :—

				Rs.
First year	..	..	..	Nil.
Second year	..	..	..	500
Third year	..	..	..	500
Fourth year	..	..	..	1,000
Fifth year	..	..	..	1,000

(iii) No part of the land to be acquired for the scheme is established orchard ; the area will have to be planted anew.

(iv) The qualifications for the Farm Manager will be a Degree in Agriculture with Horticulture as a special subject, of any recognised Agricultural College in India and experience of about five years in Horticultural work and those for the Assistant Farm Manager, a Diploma from the Horticultural School attached to the Government Botanic Gardens at Bangalore with experience in Horticultural work for about five years.

Candidates of the specified qualifications are readily available in the State.

(v) The Officer responsible for the technical control of the work will be the Superintendent, Government Gardens in Mysore, Bangalore,

who is the head of the Horticultural Department. The present incumbent of the office holds a Diploma in Agriculture passing out creditably from the Agricultural College at Coimbatore. He has had training in the Kew Gardens receiving an excellent certificate from the Director of that Institution. He is a Fellow of the Linnean Society and the Royal Horticultural Society and has visited the Experimental Stations at East Malling, Kent and at Long Ashton, Bristol and has practical experience in Fruit Culture. He has to his credit an approved service of 21 years in the Mysore Government.

The work of breeding will be carried out by the Farm Manager under the guidance of the Superintendent.

I trust that all the information required for a consideration of the scheme has been furnished but I shall be glad to furnish any further information that may be required.

APPENDIX XLVI.

NOTE, DATED THE 7TH AUGUST 1934, ON SUBJECT No. 41 : PROPOSAL TO APPOINT THREE ASSISTANTS ON RS. 120—10—150 EACH IN THE PLACE OF THE PHYSIOLOGICAL BOTANIST UNDER THE SCHEME OF FRUIT RESEARCH IN BIHAR AND ORISSA.

At its meeting held in July 1932, the Advisory Board recommended a scheme of fruit research in Bihar and Orissa as revised by the Fruit Sub-Committee of the Board, at a cost of Rs. 89,990 spread over a period of five years. Details of the original scheme and the recommendations of the Fruit Sub-Committee thereon which were accepted by the Advisory Board, will be found on pages 389-390 and 420—423 of the printed proceedings of the meetings of the Board. The scheme as revised was sanctioned by the Governing Body in October 1932.

2. It will be observed from the report of the Fruit Committee (page 390 of the printed proceedings) that one of the changes in the staff of the scheme effected as a result of its recommendation was the creation of a post of Botanist in the provincial Service scale (Rs. 200—20—750) in the place of a Botanical Assistant on Rs. 80—5—100 provided for by the Government of Bihar and Orissa. The Committee also desired that the Public Service Commission through whom the recruitment to this post would be made, should have discretion to offer such suitable salary within the scale as they might consider necessary to get a good Plant Physiologist.

3. The Government of Bihar and Orissa have now suggested (*vide* their letter No. 424-D.R., dated the 13th June 1934, copy attached—Encl. I) that as the post of Botanist was advertised by the Public Service Commission without success and as the Director of Agriculture, Bihar and Orissa is certain that there is no Fruit Physiologist of the requisite qualifications available in Bihar and Orissa or perhaps anywhere in India, they should be authorised to recruit, in the place of the Botanist, three Assistants (One Botanical, one Physiological and one Bio-chemical) on the scale of Rs. 120—10—150 each. As, however, the post of Botanist (Plant Physiologist) was included in the scheme specifically at the instance of the Fruit Sub-Committee of the Advisory Board, the Vice-Chairman to the Council considers that the proposal should first be examined by the same Committee, namely,

- (1) The Vice-Chairman, Imperial Council of Agricultural Research, Chairman (*ex-officio*) ;
- (2) The Agricultural Expert, Imperial Council of Agricultural Research ;
- (3) The Director of Agriculture, Madras ;
- (4) The Director of Agriculture, Bombay ;
- (5) The Director of Agriculture, Bengal ;
- (6) The Director of Agriculture, United Provinces ;
- (7) The Director of Agriculture, Punjab ;
- (8) The Director of Agriculture, Bihar and Orissa ;
- (9) The Director of Agriculture, Central Provinces ;

- (10) The Director of Agriculture, Assam ;
- (11) The Director of Agriculture, Hyderabad ;
- (12) The Director of Agriculture, Mysore ;
- (13) The Director of Agriculture, Baroda ;
- (14) The representative of the North-West Frontier Province ;
- (15) The Chief Publicity Officer, Indian State Railways ;
- (16) The Agricultural Officer, Baluchistan ;

The Secretary, Imperial Council of Agricultural Research, Secretary (*ex-officio*).

This Committee will meet on an afternoon between the 3rd and 8th September 1934 and its views on the proposal will be placed before the Advisory Board in due course.

4. As the Committee may desire to consider other alternatives to that suggested by the Bihar and Orissa Government the relevant extract from the information supplied to intending candidates by the Public Service Commission is attached (Enclosure II).

ENCLOSURE I.

COPY OF LETTER FROM THE SECRETARY TO GOVERNMENT, BIHAR AND ORISSA, EDUCATION AND DEVELOPMENT DEPARTMENT, No. 424-D.R., DATED THE 13TH JUNE 1934.

I am directed by the Government of Bihar and Orissa (Ministry of Education) to refer to your letter No. F. 59-8/33-Agri., dated the 27th March 1934, conveying the approval of the Imperial Council of Agricultural Research to the proposed recruitment of a Physiological Botanist, through the Provincial Selection Board, and to say that on a reconsideration of the case the local Government are inclined to think that no useful purpose would be served by re-advertising the post. The post has already been advertised once by the Public Service Commission without success and the Director of Agriculture, Bihar and Orissa, reports that to his certain knowledge there is no Fruit Physiologist of the requisite qualifications available in Bihar and Orissa or perhaps anywhere in India.

2. The Horticultural Officer who has recently joined his post also reports that the purpose of the scheme would be better served if instead of a physiological Botanist, three suitably qualified assistants are given to him as proposed below. The Director of Agriculture, Bihar and Orissa, supports this proposal with which the Director of Agriculture, United Provinces, also agrees (*vide* copies of letters enclosed).

- (1) A Botanist Assistant on Rs. 120—10—150.
- (2) A Physiological Assistant on Rs. 120—10—150.
- (3) A Biochemical Assistant on Rs. 120—10—150.

3. In the circumstances the local Government recommend the proposal to appoint three qualified assistants in place of the Physiological Botanist for acceptance. The three assistants will be recruited through the provincial Selection Board and efforts will be made to recruit science graduates with some postgraduate training in botany, physiology and bio-chemistry.

4. The proposal does not involve any extra expense to the Imperial Council. On the other hand it will mean a saving which is estimated by the Director of Agriculture at Rs. 5,000.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, BIHAR AND ORISSA, TO THE DIRECTOR OF AGRICULTURE, UNITED PROVINCES, LUCKNOW, No. 3973, DATED PATNA, THE 12TH APRIL 1934.

I have the honour to invite a reference to the combined Fruit Research Scheme sanctioned by the Imperial Council of Agricultural Research for the United Provinces and Bihar and Orissa which is to be carried out at the Agricultural Research Institute, Sabour, in this province. In this scheme provision was made for two officers—one Horticulturist and another a Physiological Botanist. Both the posts were advertised through the Public Service Commission, India. The Commission have recruited a suitably qualified Horticultural officer, who joined on the 3rd instant.

2. Twenty-one applications were received by the Public Service Commission, India, for the post of Physiological Botanist and four candidates possessing Ph. D. degree of the London University were interviewed. The Commission, of whom Mr. Burt was the co-opted expert member, came to the decision that no one of the candidates was qualified for the post and they have therefore been unable to select a suitable candidate.

3. The Physiological Botanist was intended for work mainly on the periodicity of the fruiting of Mangoes. The Horticultural Officer recruited has already done a fair amount of work on this subject and he has represented to me if given suitable assistance he will be able to carry on the investigation properly. I do not agree with him that a Statistical Assistant is at all necessary for the work and I am inclined to think that if the following three assistants are provided the object for which the scheme has been sanctioned will be achieved.

- (i) A Botanical Assistant on Rs. 120—10—150.
- (ii) A Physiological Assistant on Rs. 120—10—150.
- (iii) A Bio-chemical Assistant on Rs. 120—10—150.

If a Botanist had been appointed the total cost to the Imperial Council would have been about Rs. 30,000 for five years as the Council had agreed to give a pay not exceeding Rs. 500 per mensem to a suitably qualified man throughout the period for which the scheme has been sanctioned. If the suggestion now put forward is accepted it will mean a saving of about Rs. 5,000 to the Council which sum could be very profitably utilised in carrying the investigations. The proposal will therefore not cost the Imperial Council anything more than what has already been sanctioned.

4. I have the honour to request you to let me know if you can see your way to agree with the present proposal of appointing 3 assistants in place of one Botanist. On hearing from you I shall approach the Council through my Government for necessary alterations in the scheme.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, UNITED PROVINCES, TO THE DIRECTOR OF AGRICULTURE, BIHAR AND ORISSA, PATNA, No. 16850, DATED LUCKNOW, THE 2ND MAY 1934.

I have the honour to acknowledge the receipt of your letter without number and date regarding your proposal to appoint 3 assistants in place of one Botanist in the Imperial Council of Agricultural Research's Fruit Research Scheme, and to say that I accept them as likely to be more productive of results than a single Physiological Botanist of co-equal value with the Horticulturist. I do not think that a Statistical Officer is a pressing necessity though in course of time he might be. In the early stages on layout, etc., the Imperial Council of

Agricultural Research Statistician would be sufficient. The programme as outlined in the note attached appears to be much too extensive for even this staff to tackle.

ENCLOSURE II.

ABSTRACT OF THE INFORMATION SUPPLIED TO INTENDING CANDIDATES FOR THE POST OF A BOTANIST (PLANT PHYSIOLOGIST) SANCTIONED BY THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH IN CONNECTION WITH THE BIHAR AND ORISSA FRUIT RESEARCH SCHEME,

1. Candidates should be statutory natives of India.
2. Persons already in Government service are eligible.
3. Candidates not already in Government service should preferably be not more than 25 years of age (approximately).
4. Essential qualifications for the post are :—
 - (a) An M. Sc. degree in Botany ;
 - (b) At least two years' post-graduate training in Plant Physiology ;
 - (c) A knowledge of diseases of tropical and sub-tropical fruit trees is also desirable.
5. Pay of the post will be on the scale of Rs. 250—25—750. Initial pay on this scale will be fixed according to qualifications. (Applicants to state the lowest initial pay which they will accept.)
6. Rent free residential accommodation will not be provided. The holders of the post will not be eligible to subscribe to any Contributory Provident Fund.
7. Leave will be admissible in accordance with the rules applicable to permanent Government servants in Bihar and Orissa.
8. The pay of the post will be subject to 5 per cent. emergency cut so long as it lasts and the holder of the post will be liable to any reduction of pay applicable from time to time to other classes of Government servants of similar standing.

APPENDIX XLVII.

NOTE, DATED THE 3RD AUGUST 1934, ON SUBJECT No. 42 : REPORT ON THE EXPERIMENTAL CONSIGNMENTS OF MANGOES FROM BOMBAY TO GREAT BRITAIN DURING 1933.

At its meeting held in February 1933, the Advisory Board considered a scheme for the export of mangoes from Bombay to Great Britain for experimental purposes. The scheme was sanctioned by the Governing Body in April 1933.

2. Shipments were accordingly made during the 1933 season and the following papers in respect thereof are circulated for the consideration of the Advisory Board :—

- *(a) A note on the export of mangoes to Europe in 1933 and a further report by Dr. G. S. Cheema, Horticulturist to the Government of Bombay.
- *(b) Report on 1933 shipments by Empire Marketing Board.
- *(c) Letter from the Secretary, Imperial Council of Agricultural Research to the Director of Agriculture, Bombay, No. F. 59|2|33-A., dated the 12th May 1934.
- *(d) Letter from the Director of Agriculture, Bombay, to the Secretary, Imperial Council of Agricultural Research No. 493-A-B. 6078, of 1934, dated the 27th June 1934.

3. In this connection a reference is invited to the remarks made by a Sub-Committee of the Advisory Board on the report of the Empire Marketing Board on similar consignments of mangoes shipped during the 1932 season, which was circulated to the Board at its meeting held in August 1933. These remarks which were approved by the Advisory Board were communicated to the Government of Bombay and the enclosed letter from the Director of Agriculture, Bombay, which has been received through the local Government is now circulated for the information of the Board.

4. It may be noted that pending the conclusion of cold storage experiments, the Director of Agriculture, Bombay, has suspended the shipping of experimental consignments to Great Britain. Since with the very limited cold storage facilities available between Bombay and London at present there is no prospect of getting precise information as to the temperature under which the fruit travelled.

*Not printed.

APPENDIX XLVIII.

NOTE, DATED THE 8TH AUGUST, 1934, ON SUBJECT No. 43 : ARRANGEMENTS MADE FOR THE EXAMINATION OF EXPERIMENTAL FRUIT CONSIGNMENTS FROM INDIA TO THE UNITED KINGDOM, BY THE SCIENTIFIC AND INDUSTRIAL RESEARCH DEPARTMENT OF HIS MAJESTY'S GOVERNMENT IN THE UNITED KINGDOM.

Attention is invited to the attached copy of a letter (Enclosure I) from the Deputy Indian Trade Commissioner, London, No. T-81939, dated the 15th March 1934 and that of a note recorded by Sir Harry Lindsay on the 8th March 1934 (Annexure I) received therewith on the subject of experimental consignments of fruit from India to the United Kingdom. As proposed in paragraph 8 (c) of Annexure I, the Scientific and Industrial Research Department of His Majesty's Government in the United Kingdom was approached with the result stated in letter, dated the 14th March 1934, No. D.F.I./19/5/1 from the Department of Scientific and Industrial Research and the High Commissioner for India's letter of the 16th March 1934 (Enclosure II). The proposals made in Annexure II have been accepted so far as experiments arranged or authorised by the Imperial Council of Agricultural Research are concerned. In cases where facilities are provided at the direct request of a Provincial Government the High Commissioner for India has been requested to pass on the charges to the local Government concerned. All the local Governments and constituent States of the Council were informed of these arrangements.

It is gratifying to note that through the kind co-operation of the Department of Scientific and Industrial Research of His Majesty's Government it has been possible to avoid the inconvenience which the discontinuance of the sources hitherto provided by the Empire Marketing Board would have caused.

As facilities for proper technical examination now exist it is most desirable as pointed out by the Indian Trade Commissioner that all experimental consignments should be properly advised and arrangements made for inspection. The Advisory Board has already accepted the principle that in order to make the best use, in the interests of the whole country, of available facilities for testing and reporting on the quality of Agricultural produce, the Imperial Council of Agricultural Research should co-ordinate experimental shipments.

ENCLOSURE I.

COPY OF A LETTER FROM THE DEPUTY INDIAN TRADE COMMISSIONER, LONDON, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, INDIA, No. T-81939, DATED THE 15TH MARCH 1934.

I am desired to enclose herewith, for the information of the Imperial Council of Agricultural Research, copy of a note recorded by Sir Harry Lindsay on the 8th March 1934, on the subject of experimental consignments of fruit from India to the United Kingdom. I am to add that copies of this note have been forwarded to the Directors of Agriculture, United Provinces, Burma and Bombay, who have been asked to send early intimation to this Office of their programmes for experimental fruit consignments during the coming season. The above Directors of

Agriculture have also been asked to send copies of their programmes to you for information, as we shall be reporting to you the results of any experimental consignments that may be received.

ANNEXURE I.

This file relates to an experiment undertaken by the Director of Agriculture of the United Provinces last year for the shipment of five small consignments of mangoes to England.

2. The United Provinces mango ripens later than the Bombay mango and these consignments were not despatched until July/August of last year. Nevertheless there was some overlap with the Bombay mango consignments and moreover the London market had been so flooded from Bombay that remunerative prices were impossible. In any case, however, the United Provinces mangoes did not arrive in good condition. The reports from Covenant Garden and from the Director of Agriculture himself (serials 7, 8, 9 10-A and 12-A) are confusing. The general impression obtained from reading these reports is that some of the consignments arrived under-ripe, some over-ripe and practically none were saleable in good condition.

3. The question is what are we to do next? It seems to me that the chief defect in last year's arrangements, so far as India House is concerned, is that we were unable to arrange for expert examination and report. In the past we have received, e.g., from Dr. Cheema on the Bombay side and from the Director of Agriculture in Burma, carefully detailed summaries of the contents and history of the various boxes making up the consignments, of mangoes from Bombay and of mangoes and mangoosteens from Burma. These analyses were sent to us by air-mail in advance. We arranged for the E. M. B. expert to board the ship on arrival, take samples and examine the samples at leisure in the E. M. B. Store; and as a result of these examinations we were able to send careful technical reports to the authorities concerned in India.

4. In the present instance the consignments were addressed to Messrs. George Monro & Co. of Covent Garden and copies of the covering letters were sent to us for information (see serials 4 and 6 and enclosures). No detailed descriptions of the consignments were sent to us and as the Director of Agriculture appeared to rely entirely on Messrs. George Monro, we naturally did not interfere.

5. That procedure, was, I think, a mistake. It is quite impossible for a busy Covent Garden dealer to analyse carefully box by box experimental consignments of fresh fruit as they are received. The quantities which he handles are far too great, and he can only rely on his salesman to give him a rough idea of each consignment as a whole. The result is that the sale accounts despatched from Covent Garden to the Director of Agriculture are merely accompanied by a rough indication of the general condition of the consignment which is usually (in quite non-technical language) "hard and under-ripe" or "over ripe and rotten" or "in sound condition".

Clearly it is of the greatest importance to get really expert opinion on these experimental consignments of fresh fruits arriving from official sources in India. Neither Deputy Trade Commissioner nor I can furnish the expert knowledge required. An agricultural adviser to the High Commissioner (as originally proposed to the Government of India) would have been able to do this work better than anybody; but unfortunately the proposal for such an appointment had to be turned down from financial considerations.

6. Fortunately although the Empire Marketing Board no longer exists, it seems that expert assistance would be forthcoming from the Department of Scientific and Industrial Research, if a request to this effect were made by Agricultural Departments in India. In this connection please see the letter of 22nd

December 1933, from Mr. Knox in File No. T-84481. We do not know whether the Department of Scientific and Industrial Research would charge fees for these services. That would have to be ascertained and an attempt should also be made to find out what Departments of Agriculture in India are anxious to send experimental consignments of fresh fruit to London for expert examination and report during the forthcoming season (May to July, 1934).

7. In the linked file, on which H. C.'s orders are also solicited, will be found a valuable report by Mr. Furlong, then of the Empire Marketing Board and now of the Department of Scientific and Industrial Research, on two experimental consignments of mangoes from Burma. In those two consignments, the Director of Agriculture, Burma, followed the procedure which was not adopted by the Director of Agriculture, United Provinces, and which we may now recommend. That is to say the Rangoon Director sent us in advance full detailed descriptions of the cases making up each consignment. We arranged for the expert to visit the ship, take samples and examine them at his leisure; he sent his final report to us and we passed copies to the Department of Agriculture in Burma.

8. If H. C. approves I suggest the following action:—

- (a) To send a copy of this note to the Director of Agriculture in the United Provinces together with a copy of the report of the E. M. B. expert on the two mango consignments from Burma, as a specimen of the kind of report which is likely to be of value to Agricultural Departments in India.
- (b) To send a copy of this note also to the Departments of Agriculture, Burma and Bombay for information, and also to the I. C. A. R.; if any of these authorities have not yet received a copy of the report to Burma, they will doubtless be able to get one on application to the Director of Agriculture, Rangoon.
- (c) We will now approach the Department of Scientific and Industrial Research and find out exactly on what terms they are prepared to carry out these services.
- (d) The result of our negotiations with the D. S. I. R. will then be reported to the I. C. A. R. and copy to the Directors of Agriculture concerned, namely, Bombay, the United Provinces and Burma.
- (e) Directors of Agriculture should be asked to give us early information of their programme for experimental fruit consignments during the coming season and copy to the I. C. A. R., to whom we may wish to report results.
- (f) We should also keep the D. G. C. I. in touch with these developments.

(Sd.) H. A. F. LINDSAY.

The 8th March 1934.

ENCLOSURE II.

COPY OF LETTER FROM THE HIGH COMMISSIONER FOR INDIA, TRADE DEPARTMENT, LONDON, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, DATED THE 16TH MARCH 1934.

I am directed by the High Commissioner for India to forward herewith, for the information of the Imperial Council of Agricultural Research, copy of a letter No. D. F. I.-19[5]1, dated 14th instant, which has been received from the Department of Scientific and Industrial Research of His Majesty's Government in the United Kingdom.

2. It will be realised by the Imperial Council of Agricultural Research that on the disbandment of the Empire Marketing Board the arrangements which have

hitherto been made available to the High Commissioner for the drawing of samples, scrutiny and report on the condition of experimental fruit consignments received from Provincial Governments in India have unfortunately lapsed. These services were formerly rendered free of charge. As you will see from the enclosed letter, the Department of Scientific and Industrial Research is willing to undertake these duties in future on payment of a fee of £5 for each small experimental consignment. This fee will cover the cost of meeting the consignment on the ship on arrival; drawing samples if only part of the consignment has to be examined; examining the consignment in the Covent Garden Laboratory; and preparing and submitting a full report on the condition, packing, keeping qualities, etc. If, as will normally be the case, the consignment will be of interest from the point of view of Empire food supplies for the United Kingdom, then half this fee will be met by the Committee of the Privy Council for Scientific and Industrial Research and only half will be charged to the Provincial Government concerned.

3. I am desired to enquire whether this procedure commends itself to the Imperial Council of Agricultural Research and, if so, whether the High Commissioner may be authorised to sanction an expenditure not exceeding £5 (which would in normal circumstances amount to only £2-10-0) on each of such consignments on the understanding that the expenditure would be passed to the Imperial Council of Agricultural Research for reallocation to the Provincial Government concerned. It will also of course be arranged that a spare copy of the expert's report will be forwarded to the Imperial Council of Agricultural Research for information in each case.

ANNEXURE II.

COPY OF LETTER FROM THE DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH,
16, OLD QUEEN STREET, WESTMINSTER, S. W.-1, No. D. F. I.-19[5]1, DATED
THE 14TH MARCH 1934.

I am directed by the Committee of the Privy Council for Scientific and Industrial Research to state that they understand that the High Commissioner for India would be glad to learn whether they are in a position to examine and report upon experimental consignments of mangoes and other fruit arriving in this country from India and Burma. The Committee of Council have recently augmented the staff of their Covent Garden Laboratory (28, Endell Street, W. C.-2) by a full-time officer, Mr. C. R. Furlong, who has had considerable experience of work of this type while in the service of the Empire Marketing Board, and they will be glad to undertake such examinations.

It is the Committee of Council's practice to charge a fee for examining and reporting upon a consignment; the amount of the fee depends on the time occupied by the work, but on the basis of past experience of consignments of mangoes, it is estimated that £5, exclusive of the cost of any special travelling which may be involved, may be taken as the normal fee for examining and reporting upon a small experimental consignment. Where, however, an examination was of interest to the Committee of Council themselves, and this no doubt, would normally be the case, the amount of the fee would be reduced by one-half.

Should the High Commissioner wish the Committee of Council to undertake the examination of a consignment, it would be convenient if the fullest possible information regarding it, including, if possible, particulars of the treatment of the fruit before shipment, could be sent as far in advance of the arrival of the consignment as possible to the Director of Food Investigation at this address. The Director of Food Investigation would then state whether he was able to undertake the examination, and would, wherever possible, quote a definite fee for the work.

APPENDIX XLIX.

NOTE, DATED THE 22ND AUGUST 1934, ON SUBJECT NO. 44 : APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF RS. 74,000 SPREAD OVER FIVE YEARS FOR A SCHEME AND RESEARCH WORK OF BANANAS.

Attention is invited to the attached letter from the Government of Madras No. 846-M. S., dated the 28th June 1934 (Annexure I) forwarding a scheme of research work on bananas in the Madras Presidency. The scheme involves, so far as the Council is concerned, recurring expenditure of Rs. 68,000 and non-recurring expenditure of about Rs. 6,000 or a total of about Rs. 74,000 spread over five years.

2. It will be remembered that the Council has already sanctioned a scheme for a fruit research station on the plains in the Madras Presidency, at a cost of Rs. 66,064 spread over five years which includes *inter alia* work on plantains. The attached correspondence (Annexure II) with the Government of Madras will show the connection between the fruit scheme and the proposed research work on bananas.

3. The Vice-Chairman to the Council considers that the scheme should first be examined by the Fruit Sub-Committee of the Advisory Board consisting of:—

The Vice-Chairman, Imperial Council of Agricultural Research—Chairman *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Madras.

The Director of Agriculture, Bombay.

The Director of Agriculture, Bengal.

The Director of Agriculture, United Provinces.

The Director of Agriculture, Punjab.

The Director of Agriculture, Bihar and Orissa.

The Director of Agriculture, Central Provinces.

The Director of Agriculture, Assam.

The Director of Agriculture, Hyderabad.

The Director of Agriculture, Mysore.

The Director of Agriculture, Baroda.

The Agricultural Officer, North-West Frontier Province.

The Agricultural Officer, Baluchistan.

The Chief Publicity Officer, Indian State Railways.

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research—Secretary *ex-officio*.

This Sub-Committee will meet on an afternoon between the 3rd and 8th September 1934, and its report will be submitted to the Advisory Board in due course.

ANNEXURE I.

COPY OF LETTER NO. 846-M. S., DATED THE 28TH JUNE 1934, FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

SUBJECT.—*Scheme of research on Bananas.*

I am directed to enclose a scheme of research on Bananas proposed by the Director of Agriculture, Madras, for consideration of the Council. As regards the pay of the staff, though the average of the different scales for the non-gazetted staff has been adopted for purposes of the estimates the actual pay drawn from time to time by the incumbents will alone be debited to the grant.

2. The Provincial Research Committee by a majority recommend the scheme.

SCHEME FOR RESEARCH ON THE BANANA.

I.—INTRODUCTORY.

Position of the Banana, the problem and its value.

That the banana is one of the oldest, the most popular and the most consumed of fruits in India is too well known to need any elaborate explanation. Besides, it supplies the cheapest and one of the most easily digestible form of carbo-hydrates available, and in the most agreeable form one would wish for, and with the addition of a small quantity of milk it would make a complete and balanced food. Moreover, the cultivation of the plant is easy and profitable. A record profit of Rs. 950 nett per acre was obtained at the Agricultural Research Station, Samalkota. In spite of all the good qualities about the banana and in spite of the interest evinced by most people, it is one of the crops that has not received as much attention as it ought to have in the history of Scientific Agriculture in India.

The value of the fruit and how far research could develop the national resources of a country could easily be judged from the example of Jamaica. Though a small island with an area of only 4,207 square miles, Jamaica has become an important supplier of bananas in the world markets. As early as 1912, the island exported 22½ millions of bunches. Important disease and cyclone resistant varieties have been evolved, side industries as 'fig' making for the utilization of unmarketable produce have been developed, methods of cultivation, ripening, storage, packing for export have been standardized.

But in India the banana has been long neglected. Though every one is acquainted with the crop, no definite and accurate information as to the nature and quality of the various so-called local varieties is on record. No serious attempts have been made to utilize the fruit to the fullest extent, either for consumption or for export. There is no organized internal trade or foreign export. Facilities for transport are lacking. The question of side industries is untouched. The area under banana and the supply of bananas are purely limited to local demand.

Analysing the present position of the banana in India, the problems of investigation resolve themselves to the following items :—

- (1) Survey of plantains in and outside Presidency : To take stock of the material available and its geographical distribution. This fundamental knowledge is a necessary preliminary to breeding or trade. While the survey is being made attempts should be made to study cultivation practices and local demand for particular varieties.
 - (2) A correct classification and nomenclature of all available varieties as also their descriptions so as to avoid confusion due to the innumerable local names, in handling the material either for breeding, selection or cultural work. This work naturally includes an investigation of the variation in the morphological characters. The importance of the work consists in removing the confusion consequent on the number of misleading local names for one and the same variety.
 - (3) Study of the biology of the banana plant in general and the anatomy of the fruit in all the varieties with special reference to the keeping quality.
 - (4) Study of the habitat as also the season affecting quality (taste and keeping) and to standardize the best methods of cultivation. The habitat is studied during the survey. The season affecting the produce can be tried at Coimbatore itself by manipulating the time of planting.
 - (5) Selection of pure lines.
 - (6) Evolving of new and desirable types by hybridization and selection for quality, quantity, disease resistance, leaf production, short duration, etc. Hybridization in the banana though not generally known is possible. In Trinidad a new type was evolved by hybridization which has all the desirable qualities of Gros Michel without its susceptibility to Panama disease—a very serious devastating fungus disease of the West Indies. The difficulty of the work consists in starting with a seedless variety, then producing viable seed and finally obtaining a seedless type. A wild variety which has normal seeds is made use of as one of the parents in the beginning. The process is extremely laborious and may extend to a period of over ten years.
- ‘Chakkarakeli’ and ‘Virupakshi’ are two famous varieties of bananas in South India. The former has poor keeping qualities but strong fruit stalk while the latter has good keeping quality but very weak fruit stalk. By hybridization it may be possible to evolve a new variety with the good qualities of both. Such a variety would be almost ideal.
- (7) Methods of packing fresh bananas, their products and suckers for short and long distance markets and trials of the different methods.

- (8) Study of the diseases brought about by fungus, affecting the banana in the field and during storage.
- (9) Conducting of manurial experiments with a view to find out the best and the cheapest manure as also to know the effect of manuring on the quality of the fruit.
- (10) Rotation experiments to check the value of existing practices followed by ryots as opposed to the system of perennial cropping.

Carrying on trials in banana 'fig,' jam, preserve making, etc. It does not pay to put small bunches in the market. These side industries would serve as a means of disposing of unmarketable produce. The economics of these industries have to be worked out, for sooner or later the necessity for such side lines would arise as the main industry develops.

The value of the scheme when successfully worked out consists in its supply of fundamental knowledge of the banana and ultimately adding to the material wealth of the country and in relieving to some extent, the great unemployment now existing by way of creating new industries, some of which could be worked with profit as cottage industries.

II.—DURATION OF THE SCHEME.

Considering the vastness of the problem a period of ten years cannot be considered too long to achieve useful results. But it may in the first instance be granted to run for a period of five years and facilities provided to extend it, if necessary. The question of large scale production and the commercial and industrial utilization of banana products would arise only after sufficient preliminary work is gone through and correct knowledge of available material is gained.

III.—WORK IN MADRAS.

The importance of research on banana has been recognized by the Department of Agriculture, Madras. Experiments were started as early as 1912 at the Agricultural Research Station, Samalkot. Varietal trials and manurial experiments were conducted. The economics of banana planting were worked out. Similar experiments were conducted at other Agricultural Research Stations at Anakapalle, Maruter, Palur, Aduturai, Kallar, Taliparamba and Central Farm, Coimbatore. Experiments on material for planting, water requirements and season of planting were conducted and the economics of 'fig' making were worked out. The figures obtained from Aduturai in this connexion show a net profit of more than 50 per cent. and are encouraging. When the question of disposal of surplus stock or unmarketable produce crops up the importance of the side line like 'fig' making will become obvious.

The various experiments at the different Agricultural Research Stations could not be carried on an elaborate scale for want of staff and funds. In spite of these handicaps useful results have been obtained. It was found that the plants treated with fish guano yielded the largest quantity of produce ; but plants treated with ashes had better keeping

qualities and had sweeter taste. Plants raised from the 'eye-buds' of the rhizome were as vigorous and healthy as those raised from normal suckers. Poor drainage retarded the growth and delayed the harvest. The water-supply when reduced from 114-acre inches to 51-acre inches the flowering was retarded but the fruit ripened quicker in storage. The older the age of the sucker planted, the earlier was the time of harvest. The results obtained will have to be verified with all the important varieties of the Presidency.

In addition to the work of the mofussil stations, two years ago a beginning was made at the Agricultural Research Institute, Coimbatore, in the direction of Banana Research on a thorough, systematic way. One experienced officer of the Research Institute was entrusted with the work. A few important places in the Presidency were surveyed thoroughly, 600 suckers including seeding bananas of the Wynad forests were gathered; a small experimental area was started and the varieties of the Presidency were planted. Character study of the 37 morphological varieties covering the so-called 400 local varieties so far obtained has been in progress. These varieties have been tentatively classified into 10 groups of 37 varieties with ten sub-varieties or types. The work is incomplete and its usefulness limited inasmuch as it has been carried on a provincial basis and the sooner it is co-ordinated and incorporated with the material of the rest of India the better.

Again, due to limited staff and funds the work could not be expanded. Yet, since starting work at Coimbatore there have been various enquiries on banana from different parts of India. The newspapers say that recently the traders of Trichinopoly have been considering the possibilities of reviving export trade in banana with Northern India and are going to depute two men to study the market there.

Thus the time is opportune to push on the research on the lines chalked out and expand the work already started.

IV.—LOCATION.

Madras of all the Provinces in India, claims the largest acreage of 144,000 acres and has a variety of suitable soils. Also, the work done so far has revealed a wide range of rich material that can be made use of for various experiments. Considerable amount of preliminary work has been gone through. Experienced staff working under expert direction is available. Thus, Madras is better fitted to undertake the research on banana than any other province in India.

In the Madras Presidency, Coimbatore is the ideal place for locating the centre of research for the following reasons :—

- (1) Coimbatore is a banana-growing area.
- (2) Climate is equitable, frost and cyclones injurious to banana are absent.
- (3) Suitable wet and garden lands at the Central Farm, Coimbatore, would be available.
- (4) There is already a banana experimental area at Coimbatore where almost all the varieties of the Presidency are being successfully grown.

(5) No time need be wasted in starting the work or arranging the preliminaries.

(6) The Nilgiri Hills up to 7,000 feet above the sea level and the Malabar plains with high rainfall (80—120 inches) per annum where special varieties could be tried are in easy reach of one or two hours of journey by rail. The pomological stations at Kallar and Burliar and Coonoor in the Nilgiris and the Agricultural Research Station, Pattambi, would come in handy for trying special varieties as necessity arises.

(7) Money could be saved on the purchase of books of reference and laboratory equipment and buildings, etc.

Contribution by the Department of Agriculture, Madras.

Lease of land.

	Rs.
Two acres of land at Central Farm	500
One acre at each of the following mofussil stations, Anakapalle, Samalkot, Maruteru, Palur, Aduturai and $\frac{1}{2}$ acre at Taliparamba and Kallar	1,500
Cost of cultivation of (1) Central Farm	1,500
Mofussil stations	4,500
Books of reference	260
Laboratory	2,000
Equipment	3,000
One Assistant and Sub-Assistant at Rs. 120 and Rs. 75	11,700
Artist	3,240
Total	28,200

The value of the contribution of the Government of Madras is estimated roughly at Rs. 28,200.

Staff and cost of the scheme.

	Scale of pay.	Allotment of work.
	Rs.	
1. Banana Specialist	200—30/2—260—40/2—500 —50/2—700 (will be started on Rs. 280).	Banana survey, classification, marketing, supervision, direction, etc.
2. One assistant	105—15/2—150	Breeding work.
3. One assistant	75—7 $\frac{1}{2}$ /2—105	Preparation of banana products.
4. One fieldman	30—3/2—48	To work under the assistants.
5. One clerk	30—3/2—45—2/2—55	Office work.
6. One laboratory attender	19—2/2—33	Laboratory work.
7. Two peons	12—17	Office.

The total expenditure for the working of the scheme for five years excluding the contributions of the Madras Agricultural department is Rs. 73,955 or in round figures Rs. 74,000. In calculating the cost of staff, an estimate based on the average pay of each non-gazetted post instead of pay drawn from year to year during the period of five years has been made. Hence the cost appears to be higher than what it actually would be.

The statements of recurring and non-recurring expenditure for the five years are appended.

Area covered by the scheme and finance.

The banana is an important fruit not in one particular province as some crops are, but throughout India. Though by virtue of special advantages mentioned already, Madras has initiated the research on banana; when sufficient work has been done and experience gained it could be made available to other provinces, and the cultivation extended there in suitable places. Therefore it is but proper that the Imperial Council of Agricultural Research finance the scheme and help in expanding the work already in progress.

The importance of research on fruits has been recognized by the Royal Commission on Agriculture in India. Considering the various aspects, banana is the most consumed and the most profitable fruit to grow and any research done on it would benefit the whole of India.

Statement of recurring expenditure.

Particulars.	Average pay. Rs.	I year. Rs.	II year. Rs.	III year. Rs.	IV year. Rs.	V year. Rs.	Total. Rs.
Banana Specialist* Rs. 200— 30/2—260—40/2—500—50/2 —700 .. ..	..	3,120	3,120	3,600	3,600	4,080	17,520
Leave contribution at 12½ per cent. .. ..	..	390	390	450	450	510	2,190
Total Provincial Service (a) ..	..	3,510	3,510	4,050	4,050	4,590	19,710
One assistant at Rs. 105—15/2 —150	134	1,608	1,608	1,608	1,608	1,608	8,040
One assistant on Rs. 75—7½/2 —105	93 2/3	1,124	1,124	1,124	1,124	1,124	5,620
One fieldman on Rs. 30—3/2 —48	40 2/5	485	485	485	485	485	2,425
One clerk on Rs. 30—3/2—45 —2/2—55	42 1/12	505	505	505	505	505	2,525
One laboratory attendant on Rs. 19—2/2—33	26 7/9	321	321	321	321	321	1,605
Total, Pay of subordinate service ..	..	4,043	4,043	4,043	4,043	4,043	20,215
Leave contribution at 12½ per cent. .. ..	..	505	505	505	505	505	2,525
Total, Pay (b) .. ..	..	4,548	4,548	4,548	4,548	4,548	22,740
Two peons on Rs. 12 to 17	14.7	352	352	352	352	352	1,760
Leave contribution and pension at 1/12 .. ..	..	29	29	29	29	29	145
Total (c) .. ..	..	381	381	381	381	381	1,905
Total (a), (b) and (c) .. ..	..	8,439	8,439	8,979	8,979	9,519	44,355

* The specialist will be started at Rs. 260 from the first year itself.

Statement of recurring expenditure—contd.

Particulars.	I year.	II year.	III year.	IV year.	V year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Travelling allowance	1,000	1,000	1,000	750	750	4,500
Laboratory charges including cost of selling bags for crossing work, etc. ..	250	250	250	250	250	1,250
Purchase of books and periodicals ..	50	50	50	50	50	250
Service postage and telegrams ..	150	150	150	150	150	750
Tour charges including freight on Gov- ernment articles, coolies, labour, por- terage	300	300	250	200	200	1,250
Seeds and plants (suckers)	70	70	70	70	70	350
Manures and chemicals	330	330	330	330	330	1,650
Repairs and upkeep .. ..	..	100	100	100	100	400
Cultivation expenses including coolio, labour, wages of maistri, watchman	1,600	1,600	1,600	1,600	1,600	8,000
Photo plates, chemicals, printing paper, artist's materials, etc.	100	100	100	100	100	500
For conducting experiments in transport- ing bananas to distant places ..	200	200	200	200	200	1,000
Miscellaneous charges	250	250	250	250	250	1,250
Lease of land, 10 acres at Rs.	500	500	500	500	500	2,500
50 per acre .. Total Recurring ..	13,239	13,339	13,829	13,529	14,069	68,005

Non-recurring.

Particulars.	First year.
	Rs.
Buildings—	
(1) Store shed and drying enclosure	750
Deadstock—	
(2) Racks (10)	250
(3) Refrigerator (1)	1,500
(4) Furniture such as tables, chairs, type-writer table, etc. ..	200
(5) Purchase of implements	100
(6) Drying oven, slicing machine, grinder, jam making appliances	2,500
(7) Bottles, jars, chemicals	650
	5,950
	Rs.
Total, Non-recurring expenditure	5,950
Total, Recurring expenditure	68,005
Grand Total	73,955

ANNEXURE II.

COPY OF LETTER NO. F. 242/1934/AGRI., DATED THE 7TH AUGUST 1934, FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT.

Scheme of research on Bananas.

With reference to your letter No. 846-M. S., dated the 28th June 1934, forwarding a scheme of research on bananas in the Madras Presidency, I am directed to invite your attention to the Madras Government's letter No. 3273-III/30-1, dated the 5th November 1930, forwarding proposals for the establishment of two fruit research stations—one on the plains and the other on the Nilgiris. The fruit research station on the plains included, *inter alia*, research work on Plantain, such as identification and classification of local varieties; selection of planting material; problems of tillage, irrigation and manurial treatment with reference to yield and quality of fruit. This scheme of fruit research (on the plains) was sanctioned by the Imperial Council of Agricultural Research at a cost not exceeding Rs. 66,064 spread over a period of 5 years, *vide* this Department letter No. 491/Agri., dated the 24th February 1933, and work on it has been started by the Government of Madras recently.

2. I am to request, therefore, that before the scheme of research on Bananas now forwarded with your letter dated the 28th June 1934, referred to above, is placed before the Advisory Board of the Imperial Council of Agricultural Research, this Department may kindly be informed in detail of the connection between this and the previous scheme.

3. I am also to request that, as the dates of the next meeting of the Advisory Board are 3rd to 8th September 1934, this letter may kindly be treated as very urgent and that the information asked for in the preceding paragraph may be furnished in time to enable the present scheme being circulated to the members of the Board before the meeting.

COPY OF LETTER NO. 3545-III/34-2, DATED THE 16TH AUGUST 1934, FROM THE SECRETARY TO GOVERNMENT, DEVELOPMENT DEPARTMENT, MADRAS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA.

Scheme of research on Bananas.

With reference to your letter No. F. 242/34/Agri., dated the 7th August 1934, I am directed to explain the relation of the above mentioned scheme to the Plains Fruit Scheme forwarded in 1930, and recently sanctioned by the Council:—

- (a) The type of land needed for mango and citrus on the one hand and for plantain on the other is different. The former requires more or less dry land while the latter requires more or less wet land. It is hardly possible to select one small farm which contains land of both types. The land that has been selected

for a fruit farm in Cuddapah is quite suitable for mango and citrus. Work on plantain is, however, possible on the farm only with difficulty and to a limited extent and can be treated only as a side line of purely local value.

(b) Since the submission of the Fruit Scheme in 1930, the need for stimulating the plantain crop as a rotation crop on wet land has become urgent owing to the fall in the value of paddy. Work on plantain has, therefore, been begun on a fairly intensive scale at Coimbatore in the last 3 years and it has outgrown the narrow limits within which alone work on plantain is possible on the sanctioned fruit farm.

(c) Plantain now requires a farm to itself where the whole attention of the staff can be devoted to that crop alone. Under the present scheme, work on all aspects of the crop (including systematic classification of all Indian material, cytological study and hybridisation) is proposed to be done on a scale which will benefit not only this Province but other plantain growing Provinces too. No other Province in India has got the rich material available in Madras for comprehensive work on plantain. This has been recognised by the Imperial College at Trinidad which recently obtained for study at the College suckers of many varieties of plantain from Madras.

2. I am to add that work on the Fruit station has not yet started owing to the delay in the acquisition of land.

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APPENDIX L.

NOTE, DATED THE 5TH JULY 1934, ON SUBJECT No. 45, PROGRAMME OF WORK ON THE BOMBAY COLD STORAGE RESEARCH SCHEME FOR THE YEARS 1934, 1935 AND 1936.

At its meeting held in July 1932, the Advisory Board recommended the Bombay Cold Storage Research Scheme at a cost not exceeding Rs. 90,154 spread over a period of three years (pages 43, 389—401 and 433—435 of the Printed Proceedings of that meeting). This recommendation of the Board was accepted by the Governing Body at its meeting held in October 1932.

Attention is now invited to the attached letter (Enclosure) from the Director of Agriculture, Bombay, No. 833, dated the 13th April 1934, forwarding a programme of work to be done on the above scheme during the years 1934, 1935 and 1936. The programme is for the consideration of the Advisory Board.

ENCLOSURE.

COPY OF A LETTER FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 833 OF 1934 DATED THE 13TH APRIL 1934.

SUBJECT.—*Cold Storage Research Scheme.*

Programme of work during the mango seasons of 1934, 1935 and 1936.

I have the honour to forward herewith, in duplicate, the programme of the Cold Storage Research Scheme for the years 1934, 1935 and 1936, and have the honour to request that it may be discussed and suggestions made thereon at the next meeting of the Advisory Board.

COLD STORAGE RESEARCH SCHEME.

Programme of Research Work during the Mango Season of 1934.

During the season of 1934, the first year of these investigations, attention will be concentrated on finding out the optimum temperatures required in the cool chambers for the longest "Commercial Storage Life" of certain known varieties of mangoes, received from the various Provinces.

The Cold Storage chambers will be ready for experimental work by the 15th April 1934 and the work will be commenced from that date. (This Station will be called "The Cold Storage Research Station, Kirkee, Poona.")

The investigations will be confined to the following varieties to be received from the different provinces as noted against them :—

1. Alphonso	..	..	..	..	..	Bombay.
2. Suwarnarekha	}	..	..	..	..	Madras.
3. Peter		..	..	..	..	United Provinces.
4. ..	}	..	..	..	..	United Provinces.
5. ..		..	..	..	..	United Provinces.
6. ..	..	..	..	..	..	Bihar and Orissa.

These varieties are selected because they are popularly known to possess the longest storage life in the particular localities, and are perhaps the best known varieties from the commercial point of view.

Main Experiment:—

To find out the optimum temperatures in the Cool Chamber for ensuring the longest "Commercial Storage life" of fruit picked at different stages of maturity.

(NOTE.—This is Experiment No. 1 of the Original Scheme.)

Statements to be worked out:—

1. The relation of temperature to maturity and storage life of fruit.
2. The effect of temperature on the development of blush on the fruit.
3. The relation of temperature to any injury or breakdown of fruit during storage, including identification of any organisms that may develop.
4. The relation of temperature to chemical changes in the Alphonso fruit only during storage.
5. The relation of temperature to the rate of respiration of the Alphonso fruit only during storage.

Details of observations.—To find out the optimum temperature for the longest storage life of the fruit, the cold chambers will be regulated to a series of different graded temperatures varying from 30°F to 67° F, each chamber being controlled to only one temperature. The following temperatures will be used:—

30°F
35°F
40°F
45°F
52°F
60°F
67°F

An 8th set will be kept at ordinary room temperature. About 400 fruits—100 fruits of each stage of maturity (A, B, C, and D) of each variety will be stored in separate trays in each chamber. The fruits will be first examined after three weeks from storing and thenceforth they will be examined once a week, for purposes of working out the percentage of loss of weight and spoilage. Each time every tray will be examined and the description of the fruit will be recorded. The maximum percentage of spoilage permissible will not exceed 15%. The temperature under which the least percentage of spoilage occurs after the longest period of storage will be the optimum temperature for that variety.

Daily observations will be recorded regarding spoilage due to pitting, rotting, mold-growth, or other factors. Weekly observations will also be recorded on the development of blush, stage of ripening, etc. These observations will be recorded as shown in the attached table.

The amount of CO₂ in the atmosphere of each chamber will also be determined from time to time during the course of these investigations, and an attempt will be made to control the percentage of CO₂ by admitting fresh air from outside, as may be found necessary.

Daily observations will also be recorded on the humidity in the different chambers which factor also will be suitably controlled. The Engineer's Log will be properly maintained.

In case sufficient number of fruit is not available, the available number will be adjusted for each tray in this experiment.

Confirmatory experiment.—After the optimum temperature for the longest storage life of the fruits is determined by the main experiment, as detailed above, a consignment of fruits will be stored for confirmation of results obtained at each of the following temperatures:—

1. Optimum temperature.....control.
2. 5 degrees above the optimum temperature.
3. 5 degrees below the optimum temperature.

In this case observations will be recorded only with regard to the storage life of the fruits.

Probable date of arrival of fruits :—

Madras Presidency	..	..	..	15th April 1934.
Bombay Presidency	..	..	..	25th May 1934.
United Provinces and Bihar	..	..	..	1st July 1934.

Quantities of fruit that may be available.—Basing our calculations regarding the number of fruits which may be available for experimental purpose on the available grant and the cost of fruit, transport charges, etc., it is found that the following quantities of fruit will be available from different sources :

Name of Province.	Variety.	No. of fruit expected.	Money allotted.	Remarks.
			Rs.	
Madras Presidency ..	Suwarnarekha and Peter.	5,600	1,200	Approximately 900 each of A. B. and C. stage.
United Provinces ..	I and II variety ..	2,400	600	400 each of A. B. and C. stage.
Bihar .. ..	.. ..	The case will be decided later on.		
Bombay Presidency ..	Alphonso ..	5,600	1,180	1,400 each of A. B. and C. stage.

NOTE.—In the case of Madras, United Provinces and Bihar it is not necessary to send fruit of D. stage as the fruit at this stage will be sorted out from B. and C. stages. Besides probably fruit of D. stage might rot during transit as the distance to be covered is very long.

Programme subject to alterations.—It may be made clear at this stage that the above programme is tentative and is subject to alterations necessitated by any unforeseen difficulties.

This programme of work has been drafted in consultation with Dr. D. V. Karmarkar, the Senior Research Assistant, and Mr. C. L. Barve, the Senior Mechanic.

Any important change in the programme will be duly communicated to the authorities concerned.

Cold Storage Research Scheme.

Programme of Research work during the Orange Season of 1934.

Effort will be made to work out the "Commercial Storage Life" of Nagpur and Poona Oranges (Santras). This experiment is designed on similar lines as in the case of the main Mango Experiment with the exception that only two different stages of maturity—green and yellow—will be taken into consideration. If time permits, the chemical changes will be worked out.

These experiments will be repeated in the year 1935 and 1936 if found necessary on consideration of the results obtained in 1934.

[illegible]

COLD STORAGE RESEARCH SCHEME.

Programme of Research Work for the Mango Season of 1935.

During this season the following two experiments, problems II and III of the original scheme will be conducted :—

1. Which varieties yield fruit possessing the longest " Commercial Storage Life " ?
2. Which localities produce fruit possessing the longest " Commercial Storage Life " ?

As regards experiment No. I, it is proposed to carry out studies on a number of different varieties drawn from various Provinces. Two varieties from the Madras Presidency are to be used for the work of 1934, and hence two fresh varieties from the same Province will be dealt with during the 1935 season, thus increasing the total number of varieties under trial. The case of dealing with more varieties from the United Provinces and Bihar will also be considered in the like manner.

As regards the Bombay Presidency, the varieties under consideration will be chiefly Pairi, Malgese, Cowasjee Patel, Shendrya, Bhophya, and other good seedling varieties.

As regards Experiment II, the investigations will be conducted on Alphonso only for 1935. The fruit will be obtained from several localities, known for Alphonso, including Ratnagiri, Thana, Poona, Dharwar, and Surat. This investigation is expected to throw light upon the influence of the environments of production on the commercial storage life of the Mango. It is proposed, if possible, to carry out investigations on the chemical composition of the fruit belonging to different localities, and to find out whether the chemical composition bears any relation to the storage life of the fruit. The main chemical determinations will be those of moisture acidity, sugars and total nitrogen as in 1934 season.

As regards the quantity of fruit required for these experiments, a statement will be prepared in the light of the experience gained in 1934, and submitted to the authorities. In case it is found essential to ask for more grants in order to obtain larger quantity of fruit for experimental purposes, a case will be duly submitted to the authorities for consideration.

COLD STORAGE RESEARCH SCHEME.

Programme of Research Work during the Mango Season of 1936.

The experiments proposed for the 1936 season relate to the problems Nos. IV and V of the Original Scheme.

PROBLEM IV.—*To what extent is the " Commercial Storage Life " of fruit affected by exposure to different atmospheric temperatures ?*

PROBLEM V.—*To what extent is the " Commercial Storage Life " of the fruit affected by the use of different wrappers and packing materials ?*

As regards problem IV, the investigations will be conducted to ascertain the effect upon the subsequent commercial storage life of a variety of mango especially Alphonso and other finally selected varieties from Madras, United Provinces and Bihar of withdrawing the fruit from the cool chambers, after storage for a certain number of days and exposing it to the atmospheric temperatures for varying periods of time.

The optimum temperature for the variety will be maintained in the chambers. Experiments will be conducted with exposures to the outside varying temperatures that is, from the usual temperatures of cold countries like England to the temperatures experienced in hot countries like India. The fruit will be put back into the cold store and the storage life will be found and compared with the lots which have not been thus exposed. The idea is to find out the period of exposure which can safely be given to fruit kept in cold store without any fear of damage.

Regarding problem V experiments will be developed to study the effect of different wrappers and packing materials with a view to find out the most suitable material for these purposes. Observations will be recorded on the selected varieties of all Provinces. The

Optimum temperature for the variety chosen as determined in the previous experiments (1934) will be maintained in the chambers.

During the season of 1936, the experiment on the influence of locality (problem III 1935) will be repeated in the case of only the best variety from Madras, United Provinces and other Provinces.

The final tests on commercial scale.

The optimum temperature will be maintained in all the chambers. The best variety from the most suitable locality packed in desirable wrappers will be stored. As much fruit as is available will be kept and the storage life worked out. This is meant to confirm the results obtained from the experiments carried out for the period of three years.

The quantity of fruit required from each Province will be ascertained in the light of experience gained in 1934 and 1935 seasons. If extra expenses are found necessary to get the necessary quantity of fruit, an estimate will be submitted to the authorities for their consideration in 1935.

Chemical Methods to be used for the analytical work.

Loss in weight of the fruit during Cold Storage.—Fruit placed in two or three trays is to be weighed before putting into the store and later weighed at intervals of one week during the storage period. The weights are to be noted down and the loss in weight calculated. The results will be expressed as so many grammes loss of weight per thousand grammes of fruit.

Determination of moisture, acid, sugars and total nitrogen.

Sampling.—To get the representative sample of the fruit it is necessary to use a fairly large number, i.e., at least from 15 to 25 fruits. Only the pulp is to be taken for analysis, the peelings and the stone being rejected. The pulp for sampling will be taken from the middle portion of the fruit. The pulp so obtained will be collected together and mixed thoroughly. This will yield a representative sample of the fruit.

Moisture.—About 20 grammes of the sample will be weighed out accurately into a small flat bottomed China dish and kept in an electrically heated steam oven for about four days until it reaches constant weight. The percentage of moisture will then be calculated on the basis of fresh weight.

Acidity.—It is necessary to preserve the samples for the determination of acidity as it is not possible to carry out the determination immediately. The most suitable and reliable method for this purpose is to preserve the sample of the pulp in alcohol (95%). About 20 grammes of the sample will be weighed out in a Kelly bottle (400 cc. capacity), 100 c.c. of hot neutral alcohol added, the contents of the bottle brought to boiling in a water bath, the bottle taken out and closed immediately with a waxed cork. The determinations are to be carried out when convenient. The contents of the bottle are to be taken out in a beaker and the bottle washed out with alcohol (95%), the washings being added to the contents of the beaker. The contents of the beaker are to be strained or decanted. The solid part is to be put in the Soxhlet and further extracted with alcohol and both the extracts combined. After removal of the alcohol by distillation under reduced pressure and taking up with water, the acidity is to be estimated on aliquots of the extracts by titration with $\frac{N}{10}$ NaOH using Phenolphthalein as indicator. The percentage of acidity will be expressed as usual in terms of Malic acid.

Sugars.—As in the case of acidity, the sample is to be preserved in alcohol about 50 grammes of the material weighed accurately being used. A little Calcium Carbonate is to be added to neutralise any acids that may be present and thus check any inversion taking place.

At the time of determination, the pulp will be thoroughly extracted by using a Soxhlet. As in acidity determination the excess of alcohol will be removed from the extract by distillation under reduced pressure on water bath. The concentrated extract will be taken out from the distilling flask. The extract is to be clarified by using dialysed Iron and Potassium Sulphate (method found useful in the Agricultural College, Poona) aliquots

will be taken for determination of the reducing sugars. Lane and Eyon's Methylene Blue method will be followed (Journ. of the Soc. of Chem. Indus. Vol. 42 page 32, 1923). For hydrolysis 10% Citric acid will be employed and the invert sugar determined by the above method.

Total Nitrogen.—About 20 grammes of the sample is to be weighed out accurately and placed in a Kjeldahl Flask and treated immediately with 30 c.c. of concentrated sulphuric acid. 15 grammes of Potassium Sulphate and a pinch of copper Sulphate will be added and digested as usual. The total nitrogen is to be subsequently determined by the Kjeldahl Gunning Arnold method. ("Methods of Analysis", A. O. A. C., 1930. Chap. II, page 21.)

Estimation of the amount of CO₂ in the cool chambers.

Orsat's Gas Analysis apparatus will be used for the determinations. The same apparatus will be employed for the Respiration studies.

Date.....

Variety

Locality

Condition of cultivation.....

Time of picking.....

Kind and duration of Journey.....

Date of arrival

No. of fruits on arrival :—Grade A. B. C. D.....

Average weight of each fruit.....Total.....

No. of fruit rejected

No. of fruit put in store :—Grade A. B. C. D.....

Total

Chamber No.	Temperature Regulated.	Grade : No. of fruits.			
		A.	B.	C.	D.

Terms to be used for description of the colour of the skin and nature of damage.

Colour of Skin.

Nature of Damage.

Oil Green.

Blackening.

Pale Green.

Mould.

Greenish Yellow.

Freezing.

Brownish Yellow.

Greenish Reddish Yellow.

Skin shrivelling or wilting..

Green with Limeson flesh.

Green with Reddish Yellow.

Spotting.

Canary Yellow Orange.

Superficial blemish..

Orange with bulk red flesh.

Flesh Collapse..

Variety.....

Grade.....

Date of putting into the Cold Store.....

Chamber No.....

Temperature regulated at.....

Loss in weight during storage.
"B", individual fruit.

Serial No. of fruits.	Original weight of the fruit.	First Week.		Second Week.		Third Week.		Fourth Week.		Fifth Week.		Sixth Week.	
		Weight of the fruit.	Total Loss of Weight.	Weight of the fruit.	Total Loss of Weight.	Weight of the fruit.	Total Loss of Weight.	Weight of the fruit.	Total Loss of Weight.	Weight of the fruit.	Total Loss of Weight.	Weight of the fruit.	Total Loss of Weight.

Date of Observation :--

Amount of Carbon Di-Oxide in the various Chambers.

Chamber No.	Temperature Regulated at.	Date of Estimation.	Amount of Carbon Di-oxide, parts per thousand.
1.			
2.			
3.			
4.			
5.			
6.			
7.			
Room Temperature			

Date.....

Daily Temperature and Humidity Chart.

Chamber No.	Time of Observation.	Temperature regulated at.	Maximum Temperature °F.	Minimum Temperature °F.	Variation.		Humidity per cent.
1.							
2.							
3.							
4.							
5.							
6.							
7.							
Room Temperature.							

APPENDIX L-A.

SUPPLEMENTARY NOTE, DATED THE 29TH AUGUST 1934, ON SUBJECT No. 45, PROGRAMME OF WORK ON THE BOMBAY COLD STORAGE RESEARCH SCHEME FOR THE YEARS 1934, 1935 AND 1936.

In continuation of the Note, dated the 5th July 1934, already circulated to the Advisory Board on the above subject, the attached copy of a letter from the Director of Agriculture, Bombay, No. 838-8537, dated the 10th August 1934 (with enclosure) regarding certain changes suggested by the Horticulturist to the Government of Bombay in the programme mentioned above for 1935-36 is now circulated for the consideration of the Advisory Board.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 838-8537 OF 1934, DATED THE 10TH AUGUST 1934.

Programme of work for the Bombay Cold Storage Research Scheme for the seasons of 1934, 1935 and 1936.

With reference to your letter No. D-1493/34-Agri., dated 7th July 1934, on the subject mentioned above, I have the honour to forward herewith a copy of the letter No. 2398, dated 8th instant received from the Horticulturist to Government, Bombay, Poona, for information. I have agreed to the alterations suggested.

COPY OF LETTER FROM THE HORTICULTURIST TO GOVERNMENT, BOMBAY PRESIDENCY, POONA, TO THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, No. 2398, DATED THE 8TH AUGUST 1934.

Re programme of work for the Bombay Cold Storage Research Scheme for the mango seasons of 1934, 1935 and 1936.

I have the honour to suggest in consultation with the Senior Research Assistant, Cold Storage Scheme that the following changes may be permitted in the Cold Storage Research Programme for the year 1935-36.

1. The temperature in the chambers will be maintained at 35°, 40°, 43°, 46°, 49°, 52°, and 68°F. 30°F temperature is not found to be suitable for mango and hence it may be dropped.
2. Maturity trials will be limited to B and C stages. A and D stages of maturity are not found suitable and may therefore be dropped.
3. The two United Provinces varieties which could not be included in the experiment this year, will be included in next year's trials.
4. Trials on Nagpur Santra will also be taken up in 1935.
5. Permission also may be granted, if circumstances permit to make preliminary storage trials with other commercial fruits such as Banana and grapes, etc. The work will not be allowed to interfere with our mango programme.

APPENDIX LI.

*Report of the Standing Committee.**Present :*

Mr. B. C. Burt, Chairman,

Dr. J. K. Basu,

Mr. D. V. Bal,

Dr. W. Burns,

Mr. A. P. Cliff,

Professor J. C. Ghosh,

Dr. P. G. Krishna,

Mr. M. Vaidyanathan,

Rao Bahadur B. Viswanath.

Progress report on the scheme of research on the mechanical analysis of lateritic soils and on the nutrition of the rice plant at the Dacca University. (Subject 46). (Appendix LII.)

The sub-committee desires to express its appreciation of the way in which this work has been carried out and the results reported.

(1) *Mechanical analysis.*—The Sub-Committee considers that this new method should now be tried on soils other than lateritic soils. Professor Ghosh agrees to this and will have this done at Dacca so far as possible. In addition Rao Bahadur Viswanath, Dr. Krishna and Dr. Basu have agreed to try the method on the soils available in their laboratories and to communicate the results to Professor Ghosh. The sub-committee considers that the method has been fully worked so far as lateritic soils are concerned and that it should now be published in order that the agricultural chemists in general may have an opportunity of testing it.

(2) *The problem of nitrogen supply to the rice plant.*—The sub-committee considers that the green film obtained from Faridpur soil (Progress Report pages 15-18) should be identified as soon as possible and that the necessary material should be sent to Rothamsted for the purpose. It suggests that the Agricultural Expert should as the official correspondent of the Bureau, communicate with the Director of the Rothamsted Experimental Station on the subject and that Professor Ghosh should also write and forward the necessary material in due course.

A number of important tentative conclusions are contained in items 11 to 25 of the summary. Practically all these experiments are being repeated during the current year in order that the conclusions may be fully tested. It is suggested that the leaves of plants other than the rice plant should be examined for the organism which has been obtained from the rice leaf (progress report pages 20-21) and that special attention should be devoted to ascertaining that the two bacteria referred

to in item 24 of the summary are definitely nitrogen fixing organisms. The experiments described at page 42 (table 27) of the progress report might be repeated using more plants.

The field experiments described in this progress report are not connected with the pot-culture and water-culture experiments but deal with the amelioration of the Dacca rice soils; they are carried out on the Dacca Farm which provides the funds for them. The sub-committee considers that these experiments should continue up to a total period of five years. Apart from this, and excepting any special experiments required to confirm pot-culture or water-culture experiments, it is suggested that fertilizer experiments on rice should be left to the Agricultural Department's staff at Dacca, in order that the Research Fellow and his small staff may concentrate on the important problem of the nutrition of the rice plant which is now in a very promising stage. The sub-committee wishes to emphasise the desirability of concentrating effort on bringing the important work on nitrogen fixation to a definite conclusion.

II. Application from the Government of Bengal for an extension of the above scheme for a period of five years (Appendix LII).—The sub-committee notes with pleasure that the Dacca University has agreed to continue to provide a research fellow for this scheme and to bear their share of the expenditure and to provide the necessary facilities as hitherto, if the scheme be extended. The soil portion of the scheme has now developed into a study of the physico-chemical properties of the clay fraction of lateritic soils—which differs from the corresponding fraction in ordinary soils in several important respects as shown in the progress report for 1933-34. The sub-committee considers that this work should be continued and that part I should now be described as “An investigation on the physico-chemical properties of the clay fraction of lateritic soils and of the Dacca mixed soils”. The sub-committee considers that the work on the nutrition of rice with special reference to the nitrogen supply should also be continued as it promises to yield valuable results. The sub-committee recommends that the whole scheme be extended for a period of three years from June 1935 subject to the modifications shown below :—

(1) It is agreed that the Scientific Assistants on this scheme should now be brought on to suitable incremental scales of pay, the actual increments to be settled by the Council in consultation with the Dacca University.

(2) The sub-committee is satisfied as to the necessity of a Typist-Assistant and Laboratory Bearer. It is recommended that the annual grant for apparatus, chemicals, etc., should be reduced to Rs. 1,200 per annum (instead of Rs. 2,000) to provide for ordinary apparatus and chemicals—for which annual lists need not be submitted in future. It also recommends a non-recurring grant of Rs. 3,000 to be made available at any time during the three years, in such instalments as may be required, for special apparatus purchased with the approval of the Advisory Board.

The sub-committee does not recommend the Capital grant for equipping an additional laboratory.

Progress Report for 1933-34 on the scheme for research into the properties of colloid soil constituents by Prof. J. N. Mukherji of the Calcutta University. (Subject No. 47). (Appendix LIII.)

The progress report was approved. The sub-committee desires to record its opinion that first class work is being done under this scheme and is glad to note that the experimental difficulties have been overcome and reproducible results obtained in the electro-metric titrations.

B. C. BURT.

SIMLA,

The 5th September 1934.

APPENDIX LII.

NOTE, DATED THE 21ST JULY 1934, ON SUBJECT NO. 46, APPLICATION FROM THE GOVERNMENT OF BENGAL FOR AN EXTENSION OF THE SCHEME OF RESEARCH ON THE MECHANICAL ANALYSIS OF LATERITIC SOILS AND ON THE NUTRITION OF THE RICE PLANT, AT THE DACCA UNIVERSITY.

Attention is invited to the attached note (Annexure I), dated the 20th January 1934, circulated to the Advisory Board at its meeting held in February 1934. The Board approved of the proposals contained in paragraph 2 of that note.

2. The scheme (Annexure II) has now been received through the Government of Bengal with the recommendations of the Provincial Agricultural Research Committee (Annexure III). It will be noted that a small variation has been proposed in the programme of research under item (i). The proposals for staff include the following changes as compared to the grant originally sanctioned :—

- (a) The posts of Research Assistant and Junior Assistant under the existing scheme which are on fixed rates of pay namely Rs. 250 and Rs. 150 per mensem respectively, are now proposed to be brought on to incremental scales, viz., Rs. 275—25—375 and Rs. 170—20—250 while the post of Laboratory Assistant sanctioned under the existing scheme on the scale Rs. 60—4—80 is proposed to be brought on to the scale of Rs. 80—5—100.
- (b) Additional appointments of a typist, assistant and a laboratory bearer have been proposed.
- (c) The continuation scheme includes provision for travelling allowance at Rs. 500 per annum.

The total cost of the continuation scheme according to the proposals contained therein is Rs. 58,340 spread over a period of five years, including non-recurring expenditure amounting to Rs. 3,000.

3. In this connection the attached progress report (Not printed) on the work done under the existing scheme during the year 1933-34, which has been received through the Government of Bengal, is submitted for consideration. The reports for the previous years have already been circulated to the Board.

4. The Vice-Chairman to the Council considers that the subject should, in the first instance, be examined by the Standing Committee on Soil Science problems appointed by the Council, consisting of :—

- (1) The Vice-Chairman, Imperial Council of Agricultural Research—Chairman *ex-officio*.
- (2) The Agricultural Expert, Imperial Council of Agricultural Research.
- (3) Mr. A. P. Cliff, Deputy Director of Agriculture, North Bihar Range, Muzaffarpur, Bihar and Orissa.

- (4) Dr. J. K. Basu, Soil Physicist, Sugarcane Research Station, Bombay, Deccan—Padegaon.
- (5) Rao Bahadur B. Viswanath, Agricultural Chemist to Government, Madras.
- (6) Dr. P. G. Krishna, Agricultural Chemist to the Government of Hyderabad.
- (7) Dr. E. Mackenzie-Taylor, Director, Irrigation Research, Punjab.
- (8) The Agricultural Chemist to the Government of the Central Provinces.
- (9) Dr. J. C. Ghosh, Head of the Department of Chemistry, University of Dacca.

Secretary, Imperial Council of Agricultural Research—
Secretary, *ex-officio*.

The exact date, time and place of the meeting of this Committee will be intimated in due course. The report of this Committee will be placed before the Advisory Board when ready.

5. The subject is for the consideration of the Advisory Board. It is suggested that, having regard to the other claims on the funds of the Council and the precedence in the allotment of funds usually granted to continuation schemes, the Advisory Board will kindly consider whether the scheme should be renewed for a period of five years or if a renewal for three years would be sufficient for the present.

ANNEXURE I.

NOTE, DATED THE 20TH JANUARY 1934, ON SUBJECT No. 8 (ii), REQUEST FROM THE DACCA UNIVERSITY, DACCA, FOR THE EXTENSION OF THE TERM OF THE PRESENT SCHEME OF RESEARCH WORK (I) ON THE MECHANICAL ANALYSIS OF LATERITIC SOILS AND (II) ON THE NUTRITION OF THE RICE PLANT.

Attention is invited to the attached letter from the Registrar, University of Dacca, No. 10439, dated the 21st December 1933 (Annexure) on the subject mentioned above. In this connection it will be remembered that at its first meeting held in December 1929 the Board recommended "that an immediate grant for a period of five years be given to cover the cost of one Junior Assistant for the proposed soil investigations in order that the method of approach may be worked out and of one Senior Assistant" to enable work to be started on the assimilation of nitrogen by the rice plant. The cost involved was Rs. 24,000 spread over a period of five years. In addition a recurring grant on account of apparatus (estimated at Rs. 2,000 per annum) was to be sanctioned from year to year during the pendency of the scheme. The scheme was started in June 1930 and is to terminate in June 1935.

2. Subject to the approval of the Advisory Board, it is proposed that:—

- (a) A copy of the present communication from the Registrar, Dacca University (Annexure) be forwarded to the Government of Bengal with the request that the opinion of the

Provincial Agricultural Research Committee and the Local Government's recommendation thereon be sent to the Council not later than the 30th June 1934 ; and

- (ii) that the future of the scheme be considered at the next meeting of the Board when the report on the work of the fourth year will also be up for discussion.

ANNEXURE.

COPY OF A LETTER No. 10439, DATED THE 21ST DECEMBER 1933, FROM KHAN BAHADUR NAZIRUDDIN AHMAD, M.A., REGISTRAR, UNIVERSITY OF DACCA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI.

I am directed to say that the Executive Council of this University adopted the following resolution at their meeting held on 6th December 1933, regarding the extension of the scheme for Agricultural Research :—

“ That the Imperial Council of Agricultural Research be requested to sanction the grants which they are at present making to the Dacca University for carrying on Agricultural Research, for a further period of five years with effect from July 1935, and that they be informed that the University, on their part, will, during the above period, continue to bear their own share of expenditure and provide the necessary facilities for agricultural research as communicated in Registrar's letter No. 7019, dated the 16th November 1929. (Not printed.) ”

I am to enclose herewith for ready reference a copy of this office letter No. 7019, dated the 16th November 1929 (not printed) referred to in the above resolution.

I am to request that you will be so good as to move the Imperial Council of Agricultural Research, for the extension of the term of the scheme for Agricultural Research in the University and communicate the decision of the Council in regard to this matter to the University at an early date.

ANNEXURE II.

FROM PROF. J. C. GHOSH, D.Sc., HEAD OF THE DEPARTMENT OF CHEMISTRY, UNIVERSITY OF DACCA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH (THROUGH THE SECRETARY, BENGAL PROVINCIAL AGRICULTURAL RESEARCH COMMITTEE), DATED DACCA, THE 21ST APRIL 1934.

I beg to enclose herewith a scheme for the continuation of the researches in the Dacca University on (1) Mechanical analysis of lateritic soils and (2) Nutrition of the rice plant with special reference to the problem of nitrogen supply, for another period of five years, with effect from the 1st of July 1935. I shall be glad if this scheme is placed before the Advisory Board of the Imperial Council of Agricultural

Research in its next meeting for favour of consideration. I may point out that the grant sanctioned for this scheme for the first period of five years amounted to Rs. 40,500 approximately.

A scheme for the continuation of the researches in the Dacca University on the (1) Mechanical analysis of lateritic soils and soils of lateritic origin associated with silt ; and (2) Nutrition of the rice plant with special reference to the problem of nitrogen supply ; for another period of five years, with effect from July 1935.

The Advisory Board of the Imperial Council of Agricultural Research at its meeting at Pusa in December 1929, approved the original scheme submitted by Prof. J. C. Ghosh in November 1929, and recommended that the work should be started in the first instance with the aid of a senior and a junior assistant for a period of five years to work out the methods of approach. This was finally approved by the Council, and the work was begun from 1st June, 1930. Later on the Council sanctioned the appointment of a Laboratory Assistant. The results obtained so far were submitted to the Council in the form of progress reports for successive years. These reports were annually examined by a Sub-Committee of the Advisory Board and the work was modified from time to time in the light of the suggestions made by that Committee. The progress report for the fourth year which has just been submitted, will be available for examination along with this application for the continuation of the scheme.

In pursuance to the wish of the Sub-Committee, referred to above (*vide* remark made in July 1932), a method for the mechanical analysis suitable for all types of lateritic soils has been developed. This part of the work, therefore, may be considered as complete. Nevertheless, it was noticed that 30 to 40 per cent. of the finest fraction was obtained in the mechanical analysis of a number of Indian lateritic soils, yet these soils could be cultivated in a high state of moisture. The texture of the soils would be completely ruined if they contained anything like such high percentages of clay. A study of the colloidal behaviour of the finest fraction of these soils and of the mechanism involved in their production appears to be of great importance both from the point of view of fundamental research and practical application. Further, the Royal Commission on Agriculture recommended the carrying out of field experiments on the amelioration of lateritic soils by treatment with lime and other fertilisers. Although in the original scheme submitted by the Dacca University this type of work was not included, facilities being available in the Dacca Farm, field experiments to ameliorate lateritic soils by treatment with inorganic fertilisers were started two years ago with financial aid from the Government of Bengal, Department of Agriculture. Very interesting results have already been obtained and given in full in the progress report for the fourth year. It is intended not only to continue these experiments but to extend them to include the treatment with organic fertilisers and green manures.

As regards the nutrition of the rice plant, although considerable progress has been made on the problem of nitrogen fixation in paddy soils and on the influence of various essential elements and boron on the

growth of paddy, our knowledge on the subject is still inadequate, and much work remains to be done before it may be regarded as satisfactorily solved. In agricultural problems, the laboratory experiments are only preliminary to field trials and provide information, the translation of which in field practices constitutes the real problem. Sir John Russel has rightly remarked, "In academic science the handing over a discovery to the technical workers marks the end of a story. In agricultural science it simply opens a fresh chapter."

The study of a problem under a particular set of conditions will yield results which become of little use when the condition changes. As an illustration, it may be mentioned that our results on the fixation of nitrogen in water-logged soil have no bearing on the nitrogen supply to the highland paddy (Aus), although it is the experience of the cultivators of Bengal that Aus paddy enriches the soil for succeeding crop. Evidently, the bio-chemical transformation occurring in the highland paddy soil is different from that in water-logged soil. The evolution of gases and the rapid ammonification which are peculiar to water-logged soil will not be favoured under conditions prevailing in the highland.

The programme of the work should, therefore, be wide enough so that the problem may be studied under a variety of conditions, for only in this form is the information really useful to farmers working under different conditions of soils and climate.

It is hardly necessary at this stage to emphasise the importance of this work which was already appreciated by the Imperial Council of Agricultural Research. Neither it is considered necessary to give a detailed programme of the investigations which are already in progress and whose continuation is necessary for a proper understanding of the nutrition of the rice plant.

It is requested, therefore, that the Imperial Council of Agricultural Research will be pleased to sanction the continuation of this scheme of research work on—

(1) Indian lateritic soils, and

(2) Nutrition of the rice plant with special reference to the problem of nitrogen supply,

for a further period of five years, from 1st July 1935.

The actual programme of work will be drawn up in consultation with the Agricultural Expert to the Imperial Council after the suggestions of the Sub-Committee of the Imperial Council of Agricultural Research appointed to examine the fourth year's progress report have been received.

The staff already sanctioned on the old scheme consist of one Senior Assistant (a Bio-Chemist) on Rs. 250 a month, one Assistant (a Soil Chemist) on Rs. 150 a month and a third Junior Assistant (a Chemist) on Rs. 68. It is now suggested that they be placed in the following grades of salary :—

One Senior Assistant (Bio-Chemist)—Rs. 275—25—375.

One Assistant (Soil Chemist)—Rs. 170—20—250.

One Junior Assistant Chemist—Rs. 80—5—100.

The following additional staff is also considered absolutely necessary :—

One Typist Assistant—Rs. 60—4—80.

One Laboratory Bearer—Rs. 19—1—25.

A capital grant of Rs. 3,000 is required to fit up, as a laboratory, an additional floor-space of 1,000 sq. ft. which the University of Dacca has kindly provided. In addition to the above, the present recurring grant of Rs. 2,000 should be continued subject to details of chemicals and apparatus being approved by the Imperial Council of Agricultural Research and a provision for Rs. 500 annually be made to cover the travelling expenses of the staff in connection with the work.

Total Expenditure.

Recurring.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. One Senior Assistant (Bio-Chemist) on Rs. 275—25—375)	3,300	3,600	3,900	4,200	4,500	19,500
2. One Assistant (Soil Chemist) on Rs. 170—20—250	2,040	2,280	2,520	2,760	3,000	12,600
3. One Junior Assistant (Chemist) on Rs. 80—5—100	960	1,020	1,080	1,140	1,200	5,400
4. One Typist Assistant (Science Graduate) on Rs. 60—4—80	720	768	816	864	912	4,080
5. One Laboratory Bearer on Rs. 19—1—25	228	240	252	264	276	1,260
6. Grant for apparatus and chemicals, etc.	2,000	2,000	2,000	2,000	2,000	10,000
7. Travelling allowance	500	500	500	500	500	2,500
Total . . . . .	..	..	..	..	..	55,340
Capital grant . . . . .	..	..	..	..	..	3,000
Grand Total . . . . .	..	..	..	..	..	58,340

APPENDIX LIII

NOTE, DATED THE 15TH AUGUST 1934, ON SUBJECT NO. 47, PROGRESS REPORT FOR 1933-34 ON THE SCHEME FOR RESEARCH INTO THE PROPERTIES OF COLLOID SOIL CONSTITUENTS BY PROFESSOR J. N. MUKHERJI OF THE CALCUTTA UNIVERSITY.

At its last meeting the Advisory Board recommended an extension of this scheme for three years with effect from the 1st October 1935, a copy of the report of the Soil Science Committee (Annexure I) and of the relevant portion of the Advisory Board Proceedings (Annexure II) on the subject is attached. For convenience in reference a copy of "a scheme of work on Soil Colloids" is also enclosed (Annexure III).

2. The progress report for 1932-33 was considered by the Board in August 1933 (*vide* pages 40-41, 384 and 586-587 of the printed proceedings).

3. Professor J. N. Mukherji has now submitted a detailed progress report for the year 1933-34 (not printed). The Vice-Chairman to the Council considers that the report should first be considered by the Standing Soil Science Committee of the Council which consists of the following gentlemen :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Mr. A. P. Cliff, Deputy Director of Agriculture, North Bihar Range Muzaffarpur, Bihar and Orissa.
4. Dr. J. K. Basu, Soil Physicist, Sugarcane Research Scheme, Padegaon, Bombay—Deccan.
5. Rao Bahadur B. Viswanath, F.I.C., Imperial Agricultural Chemist.
6. Dr. Krishnan, Agricultural Chemist to the Government of Hyderabad.
7. Dr. E. Mackenzie Taylor, M.B.E., Ph.D., D.Sc., F.I.C., Director, Irrigation Research, Punjab.
8. The Agricultural Chemist to the Government of the Central Provinces.
9. Dr. J. C. Ghosh, D.Sc., Head of the Department of Chemistry, Dacca University, Dacca.
10. The Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The Committee will meet on some convenient afternoon between the 3rd and 8th September 1934 and its report will be submitted to the Advisory Board in due course.

The subject is now for the consideration of the Advisory Board.

ANNEXURE III.

EXTRACT FROM A LETTER FROM THE GOVERNMENT OF BENGAL, AGRICULTURE AND INDUSTRIES DEPARTMENT, No. 123-TAI, DATED THE 12TH MAY 1934.

* * * * *

I am to forward herewith, for favour of inclusion in the agenda of the meeting of the Advisory Board to be held in July 1934, the marginally noted schemes which have been approved by the Bengal Provincial Agricultural Research Committee, together with relevant extracts from the minutes of the meeting of the Committee held on the 9th May 1934. I am to say that the Government of Bengal (Ministry of Agriculture) recommend the scheme subject to the condition that no financial liability devolves on them. 150 spare copies each of the scheme will be forwarded to you direct by the Director of Agriculture, Bengal.

* * * * *

Extract from Minutes of the eighth meeting of the Bengal Provincial Agricultural Research Committee held on Wednesday the 9th May 1934.

* * * * *

2. Scheme by Prof. J. C. Ghosh of Dacca University for continuation of researches on (1) Mechanical analysis of lateritic soils and soils of lateritic origin associated with silt ; and (2) nutrition of the rice plant :—

The application from Prof. J. C. Ghosh for continuation of research on (1) mechanical analysis of lateritic soils and (2) nutrition of the rice plant, was considered.

Mr. Carbery proposed that as the work on lateritic soil has very considerably advanced, the effect of silt in admixture with the lateritic soils should be part of the research. To this, Dr. Ghosh agreed and the proposal was approved by the Committee with the proviso that item (1) should be altered to 'mechanical analysis of lateritic soils and soils of lateritic origin associated with silt'.

* * * * *

ANNEXURE I.

COPY OF AN EXTRACT FROM THE REPORT OF THE FIRST MEETING OF THE STANDING SOIL SCIENCE COMMITTEE.

Subject 27 (i).—Application from the Government of Bengal for a continuation grant of Rs. 18,800 spread over three years for research into the properties of colloid soil constituents by Professor J. N. Mukherji, Calcutta University.

Professor Mukherjee outlined the History of the scheme and said that in the original proposal two Research Assistants had been proposed. The essential feature of the scheme was the comparative study of the colloidal acid complex in clays and of colloidal aluminium hydroxide and colloidal silicic acid; also a study of the differences between the properties and behaviour of colloidal acid clays and the above pure substances and mixtures of them.

2. The Committee are satisfied of the need for an experienced Research Assistant who can be retained for the full period of the scheme. They are convinced of the value and importance of this fundamental work on the colloid constituents of soils and recommend the extension of the scheme for sanction. They consider that a suitable salary for the Senior Research Assistant should be Rs. 250—275—300 per mensem, a recommendation which Professor Mukherji accepts. The Committee consider that, even allowing for the fact that the full resources of the University physico-chemical laboratory have been placed at the disposal of the scheme, the annual provision for equipment is too small and that a small sum may also be required for travelling allowance for the assistants. It is therefore proposed that the saving of about Rs. 900 effected by the change in the salary of the Senior Research Assistant should be devoted to this purpose. With this modification the Committee recommend the scheme for sanction.

* * * * *

ANNEXURE II.

COPY OF AN EXTRACT FROM THE PROCEEDINGS OF THE NINTH MEETING OF THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, HELD AT NEW DELHI ON THE 23RD FEBRUARY 1934.

Report of Committee on Soil Science Schemes—(i) Application from the Government of Bengal for a continuation grant of Rs. 18,800 spread over three years for research into properties of colloid soil constituents by Professor J. N. Mukherji of the Calcutta University [Subject No. 27 (i) of the Agenda].

Professor Mukherjee introduced the scheme which had been examined by the Standing Soil Science Committee and commended it for approval subject to the modifications made therein by the Committee. Dr. Nazir Ahmad referred to Dr. Bhatnagar's scheme on the effect of ions on plant growth which was already in progress and enquired whether the present scheme would in any way amount to duplication of work. Dr. Nehru was of the opinion that the two schemes were complementary to each other. Professor Mukherji

explained that his scheme did not aim at any results on plant growth. He would when carrying out the present scheme, confine work to the soil side and would not touch the botanical side at all. Mr. Carpenter said that the work which Professor Mukherjee proposed to do was purely chemical and not directly for the benefit of agriculturists but the work would be of great value to agricultural research workers in the various branches of soil science and thus to the agriculturists. The report of the Soil Science Committee relating to the scheme was then adopted.

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ANNEXURE III.

A SCHEME OF WORK ON SOIL COLLOIDS.

Introduction.

When I first approached the Imperial Council of Agricultural Research for a grant for financing Researches on Soil Colloids, I pointed out that the services of two Research Assistants—one on Rs. 300 per month and the other on Rs. 150 per month—would be necessary for the purpose. The person appointed at the higher salary would be able to take charge of the work which covers an extensive field of enquiry. The Council found it possible to sanction the appointment of only one Research Assistant at Rs. 150 per month. In view of the results obtained in connection with the work already done under the present scheme and the recent work of Mattson and others, extensive measurements requiring the whole-time devotion of two men are necessary; so that the preliminary results can be followed up and definite conclusions may be arrived at within a reasonable period. I regret that through an oversight a request was made for a second Research Assistant without particulars of the scheme and the Advisory Board did not find it possible to recommend the appointment in the absence of necessary particulars (*vide* letter No. F. 34/33/Agri., dated the 13th October 1933).

The work under the existing grant has, as will be evident from the accompanying scheme, sufficiently advanced to warrant the services of a really experienced and qualified man who will be able to relieve me to a considerable extent in the matter of guidance. On second thought I have found it desirable to ask for the appointment of an assistant on Rs. 300 as stated in the first scheme as against Rs. 150 as stated in the scheme recently considered by the Advisory Board (*vide* letter No. F. 34/33/Agri., dated the 13th October 1933).

Scheme.

In connection with the work undertaken with the support of the Imperial Council of Agricultural Research, our first objective has been to ascertain the points of difference, if any, between the properties of the acid constituents of soil in a state of colloidal solution and those of acids in true solution. Two papers have been published in the Indian Journal of Agricultural Science and a third paper has been communicated for publication. The results show that a treatment of colloidal solutions of acidic substances from the point of view of classical electro-chemistry is not justifiable. The application of the usual

electro-chemical theories is limited by reactions involving interfaces in which the total quantities of the acid taking part in the reaction, are not defined by the amount of the acid substances present in the system. The forms on the titration curves show that the presence of an interface renders it necessary to consider such factors as determine the amount of the acidic constituents present in the interface which enters into reaction under any set of conditions. The equilibrium condition is thus determined by the ratio of the active interface to the volume of the solution, by the time of interaction and by the adsorption of ions. The interaction with an alkali is perhaps not simply a neutralisation of existing hydrogen ions—either, in a free, or, in a “bound” condition—but the adsorption of the hydroxyl ions by the surface with a consequent change in the acid neutralising capacity of the system, has to be considered. Dissociation constants and definitions of strength of acids on the basis of which the equilibrium conditions can be formulated have not the same significance as in usual electro-chemical systems. The experimental investigations have dealt with titration curves of some insoluble acidic substance and of colloidal solutions of silica and of aluminium oxide. The manner of variation of the hydrogen ion activity of silicic acid sols on dilution has also been studied. It has been found, contrary to the conclusions of previous authors, that silicic acid sols show apparently the characteristics both of a strong and a weak acid. There is also evidence indicating that it is difficult to reconcile the observed activities of the ions with their specific conductivities. It will be seen that the factors which distinguished the properties of colloidal acid solutions from those of acids in true solution are of a complicated nature. So far it has been possible to deal with only a fringe of the problem and the enquiry may be profitably extended. In soil, however, we have to consider still more complicated reactions. The manner of association of the sesquioxides with the acidic constituents, the extent to and the manner in which the sesquioxides serve as acid reservoirs and retain other ions in a state of adsorption, are some of the questions on which definite information seems to be lacking. Moreover in order to obtain a clear conception of the properties of the colloidal complex, it is necessary to investigate the properties of those systems other than those dealing with their interaction with alkali.

The main lines of work which may be profitably undertaken are—

- (1) The extension of the enquiry on the acidic properties of the individual soil constituents.
- (2) The manner in which the individual properties of these substances are effected by their mutual admixture by the presence of sesquioxides and by electrolytes.
- (3) Other characteristic colloidal properties of the colloidal complex and other constituents of soil.

In order to carry out the above programme it is necessary that a number of persons devote themselves to this work for a period extending over several years. I would have hesitated to undertake the work and still more to approach the Imperial Council for further grants were it not for the fact that the experience gathered by us in this laboratory enables me to hope that we shall be able to carry out a substantial portion of the programme. I would like to mention also that it will be possible for me to avail to some extent of the services of

research students provided they can be associated with more experienced persons whose continuity of service can be relied upon. The investigation of systems which are not constituents of soil but are allied in nature, is expected to yield useful information. I intend to allot such problems as also those which have reached a stage when they can be undertaken without too much of guidance, to ordinary research students.

I would therefore request the Imperial Council of Agricultural Research for the appointment of a second Research Assistant and for a non-recurring grant as detailed in the statement of cost given below. If a second Research Assistant be sanctioned, I propose to distribute the work as follows—

A. The existing Research Assistant would continue the work he is doing at present. The problems he would take up are indicated below :—

- (1) Conductometric and Potentiometric titrations, measurements of activities of ions of the following sols prepared under different conditions, allowing different times of interaction and in general in continuation of the present work :—

Silicic acid, humic acid, colloidal acid clay isolated from different soils of known history wherever possible; ferric oxide, aluminium oxide, and mixed suspensions of the sesquioxides and the acidic constituents.

- (2) Work with the above systems in presence of such electrolytes as are often present in soil.

I hope that information thus obtained will also be of help in understanding the manner in which ions of aluminium, iron, chlorine, sulphate, HCO_3 , etc., are associated with the soil and the extent to which aluminium, iron, silica, humic acid, etc., enter into reactions under different conditions.

B. The work to be undertaken by the other Research Assistant will be as follows :—

- (1) The study of soil colloids in a gel state, the effect of the degree of dispersion, of SiO_2 to R_2O_3 ratio in relation to properties of colloidal clay.
- (2) The acid properties of soil colloids and their mixtures in a gel condition, such as total acidity, ionic exchanges, electro osmosis.
- (3) Properties of acid colloidal clay and its salts.

Settling velocities, degree of dispersion and dilution, evidence of primary particles and their aggregation, cataphoretic speeds, coagulation, thixotropy, an ion association, evidence of the extent of reaction of the alumina, silicon oxide and ferric constituents in such systems.

It is perhaps not necessary to deal in details with the relationship of such investigations to practical problems of agriculture. The above enquiry is expected to yield useful information on the nature of the colloidal complex and its properties which are of fundamental interest to the physico-chemical interactions in soil responsible for soil acidity, base exchange, interaction with lime, leaching, percolation and other properties of the colloidal clay complex.

J. N. MUKHERJEE.

APPENDIX LIV.

REPORT OF THE SUNN-HEMP COMMITTEE.

Present :

1. Diwan Bahadur Sir T. Vijayaraghavacharya (Chairman).
2. Mr. M. Carbery.
3. Mr. Hill.
4. Mr. A. M. Livingstone.
5. Mr. S. V. Ramamurty.
6. Mr. P. B. Richards.
7. Mr. J. H. Ritchie.
8. Mr. T. S. Sabnis.
9. Mr. D. R. Sethi.

2. *Note by Mr. Churchill, Dy. Director of Agriculture, Northern Circle Central Provinces, on sunn-hemp as a fibre crop in the Central Provinces (Subject No. 49, Appendix LV).*—The note put in by Mr. Churchill was passed without comments.

3. *Application from the Government of Madras for a grant of Rs. 1,500 spread over three years for a scheme of experiments on the improvement of sunn-hemp fibre at the Agricultural Research Station, Samalkota (Subject No. 50, Appendix LVI).*—Mr. Ramamurty introduced the scheme. The Committee agreed that this was a useful scheme and recommended it for sanction.

4. *Application from the Government of Bombay for a grant of Rs. 1,500 spread over three years for research work on sunn-hemp in the Bombay Presidency (Subject No. 51, Appendix LVI).*—The Committee recommended that the scheme which was a useful one, be approved.

Mr. Sethi stated that in Bihar and Orissa the Botanist wished to do similar work on sunn-hemp. He therefore requested that a similar amount of Rs. 1,500 should be provided for Bihar and Orissa. He would submit a scheme before the next meeting of the Advisory Board. Mr. Ramamurty stated that if Bihar and Orissa would put up a scheme on exactly the same lines as the other provinces and if the Agricultural Expert and the Vice-Chairman to the Council approved of it, then it might go straight before the Governing Body at its next meeting. If, however, they did not approve of it, then it might be circulated to the Advisory Board in the usual way. This was agreed to.

5. *Application from the Government of the Central Provinces for a grant of Rs. 20,060 spread over five years for a scheme of research work on sunn-hemp in the Central Provinces (Subject No. 52, Appendix LVI).*—Mr. Ritchie explained the scheme. It was pointed out in discussion that the non-recurring expenditure asked for, namely, Rs. 10,000 was for machinery which was already provided for in the sanctioned United Provinces sunn-hemp scheme and that it was not necessary at the present stage to duplicate work in respect of the testing of similar machinery. It was agreed that the results of the approved United Provinces Scheme should be awaited. Items 1 to 3 of the scheme which were the botanical part were recommended for sanction, with the addition of Rupees 600 (non-recurring) for three retting tanks.

T. VIJAYARAGHAVACHARYA.

6th September 1934.

APPENDIX LV.

NOTE, DATED THE 3RD AUGUST 1934, ON SUBJECT No. 49, NOTE BY MR. CHURCHILL, DEPUTY DIRECTOR OF AGRICULTURE, NORTHERN CIRCLE, CENTRAL PROVINCES, ON SANN-HEMP AS A FIBRE CROP IN THE CENTRAL PROVINCES.

Attention is invited to the attached copy of a letter No. 117-Agri., dated the 14th January 1933, to the Government of the Central Provinces (Annexure I). The note on Sann hemp received in reply from the Government is submitted for the consideration of the Advisory Board (Annexure II).

2. Reference is invited to the note dated the 26th July 1934, already circulated to the Board, with applications from the Governments of Madras, Bombay and the Central Provinces for grants for research work on Sann hemp in those provinces. The present note (Annexure II) will first be placed before the Sub-Committee of the Board appointed to consider the schemes referred to above, namely :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
- 3—8. The Directors of Agriculture, Madras, Bombay, Bengal, United Provinces, Bihar and Orissa and the Central Provinces.
9. Mr. T. S. Sabnis (subject to the approval of the United Provinces Government).

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

The report of the Committee will be submitted to the Advisory Board in due course.

 ANNEXURE I.

COPY OF LETTER FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO THE SECRETARY TO THE GOVERNMENT OF THE CENTRAL PROVINCES, AGRICULTURE DEPARTMENT, NAGPUR, No. 117/AGRI., DATED THE 14TH JANUARY 1933.

Recommendations contained in the report on Hemp Marketing in India by Mr. T. S. Sabnis.

I am directed to say that Mr. T. S. Sabnis who was appointed by the Imperial Council of Agricultural Research to conduct an enquiry into the problem of hemp marketing in India, has, in para. 85 of his report, recommended that the possibilities of breaking and scutching of green as well as retted stems, by hand and power machines should be investigated. An *ad hoc* committee was appointed to consider the recommendations contained in Mr. Sabnis's report and it was stated in the course of discussion at the meeting of the Committee that a good deal of work in connection with breaking and scutching by hand machines had been going on for some considerable time under Mr.

Churchill, Deputy Director of Agriculture, Northern Circle, Central Provinces. The Committee accordingly recommended that a report on the subject might be obtained from the Director of Agriculture, Central Provinces, before it considered the possibility of arranging for a more intensive investigation of these problems at some central station. I am to request, therefore that if the Central Provinces Government have no objection, the Director of Agriculture, Central Provinces, may kindly be instructed to furnish this Department, as early as possible with a report on the work referred to above.

ANNEXURE II.

SANN HEMP (CROTOLARIA JUNCIA) IN THE CENTRAL PROVINCES AS A FIBRE CROP BY MR. CHURCHILL, DEPUTY DIRECTOR OF AGRICULTURE, NORTHERN CIRCLE, C. P.

Preliminary note.—This plant grows well in many districts in the Central Provinces and for a long time has been known as one of the most satisfactory forms of green manure. It is also one of the best known sources of fibre for rope and string making in Central India. It grows particularly well on well drained hill sides, and in lighter soils during the rains. It is sown at the beginning of the rains, the normal seed rate being about 100 lbs. per acre. For fibre production, the best crops are to be found in the Satpura Hills, in the upland districts of Mandla, Chhindwara (including Seoni-Chappara) and Betul. It very quickly shows signs of water logging, and will not thrive in any soil, which is badly drained. It is harvested dead ripe in November. It is then made up into bundles and taken to the nearest suitable water, nulla, river or tank, for retting. The water is usually foul and dirty, and is still further polluted by the sann straw. The smell in the locality is also not very pleasant. The industry therefore is not a very popular one in many areas. This is one reason for the caste prejudice against it. Most of those handling it are of the lower castes. This retting process takes about eight days. The bundles are then removed from the water, and are set out to dry. As soon as they are dried the scutching process begins.

The acreage outturn in dry retted straw varies enormously. Mukerji gives the outturn in cleaned fibre as from 200 to 1,200 lbs. per acre. This would mean a dry retted straw outturn of 2,500 lbs. to 15,000 lbs. per acre. Mollison records a yield of 6,280 dry retted straw and 520 lbs. finished fibre per acre. The present Extra Assistant Director of Agriculture, Jubbulpore, was Superintendent of Powarkhera Farm, when sann was a very popular crop, and the yields from the fertile lands of Powarkhera were as high as 16—20 maunds per acre of clean fibre. This is equivalent to an outturn of 16,000 to 20,000 lbs. per acre in dry retted straw. The Powarkhera fields in question are particularly well drained and fertile. Although the matter will be mentioned later on, it should be noted here that there is no claim made that the quality of fibre obtained from this type of crop, is at all desirable.

The scutching process is carried out by hand, as a 'cottage' or village industry. In the Central Provinces the ordinary way is to break single stalks and strip them, some experts may break two. The inside

pith or "shieve" is thrown aside and is known as "sann kari". As mentioned above a good deal of this work is done by the lower castes, it is frequently carried out also by Gonds and other semi-aboriginals. It is a fair average, to obtain a ratio of 8 per cent. clean fibre to dry retted straw, and from a really good type fibre crop, it is necessary to be satisfied with a clean fibre outturn of 500 lbs. to 600 lbs. per acre, if the ordinary "country" cultivation and process are used.

A normal man from the Satpura Hills, used to hand scutching, can produce about 5—6 seers (12 lbs. roughly) fibre *per day*. As far as the Central Provinces is or was concerned the qualities of fibre best known to the "trade", were Seoni Fine and Itarsi Fine. The Seoni referred to is the Seoni-Chapara Sub-division of Chhindwara District. The name Jubbulpore was also mentioned, but it is thought that this was only another grade of Seoni Fine. The better fibre was Itarsi Fine, which probably came from the Satpura Hills around Betul. Seoni Fine has a rather greenish immature look and a distinct smell. Itarsi Fine is a better colour and more uniform.

The hand scutched products are collected in various centres by merchants, bailed in rather crude presses and despatched by road and rail.

We are now in a position to study the situation, which arose subsequently to a period around 1920, when India was faced with the possibility of finding through Sann hemp fibre, a fair export market for another of her agricultural products. This was brought about by the demand for this class of fibre being in excess of the supply, on account of the partial failure of the former main source of production, Russia.

Attempted improvements and other experimental work in the C. P.

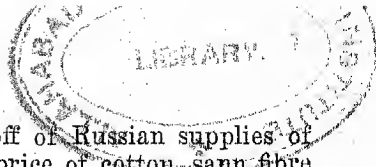
It was suggested in various quarters, that India might be able to establish herself firmly on the market, before the recovery of Russia.

It was certain however, that various changes would have to take place in the Indian production processes, before this very desirable end could be attained. Looked at from a purely provincial point of view, a large increase in the area under this crop, offered no difficulties. There were and are large tracts in the Satpura Hills and elsewhere in the Central Provinces where Sann hemp as a fibre crop would flourish.

It therefore seemed that the first problem to be tackled, was the discovery of an improved method of scutching. From the point of view of a world market, the hand scutching process, leaves much to be desired.

The three main objections to it are :—

- (1) It is much too slow. The outturn per unit of 12 lbs. per day is hardly a commercial standard. It is somewhat expensive.
- (2) It is very difficult to standardise the products. There is no gauge or standard. One man will do better work than another.
- (3) It is too gentle a process. Too much mud, dust and general rubbish are left on the so-called finished fibre. Too many weak elements in the fibre are left in.



In 1925 owing to rumours of the falling off of Russian supplies of hemp, and the threatened rapid decline in the price of cotton, sann fibre began to attract attention in Chhindwara and other hemp growing districts. It was decided to make an effort to experiment with the scutching arrangements. It became desirable to attempt to introduce a suitable form of machine, which did the work more quickly, and also more thoroughly. Accordingly a Marshalls' Automatic Scutcher was sent to Chhindwara Farm. This machine was originally designed for scutching Flax. It was of very simple construction, and was driven by a 5 B.H.P. Kerosene Engine. Details of its construction are not within the scope of this note.

Attempts were made to scutch with this machine. Good retted straw was used, and it soon became obvious that a great deal more of experience and skill was necessary on the part of the operator delivering the straw to the machine. The process was not purely a mechanical process. The "stricks" of straw had to be held by the operator, as is the case with the Belgian, Flemish or Irish scutching wheels. Well dried unbroken retted straw was used, also broken straw. The lack of skilled labour led to the machine being far too severe on the material. The fibre was "finished" to such an extent, that there was very little of it left. Every bit of the dust and mud was cleaned out, as were all but the very strongest fibres, a fair quantity of fibre was collected.

As the machine was run at the correct speed, Messrs. Marshall Sons and Company,—the makers, directed that the steel blades of the beaters should be removed leaving only the wooden ones. This did improve matters. Specimens of this and the previously produced fibres were sent for report. The reports were glowing, but accurate figures had been kept and the acreage outturns of this type of fibre worked out at 30 lbs. per acre. This of course was not a 'commercial proposition', at all. Various attempts were made to improve the outturn. Speeds were altered, dry retted straw previously broken was tried, but the results were not satisfactory. Eventually locally made Swedish Flax Breakers were used, made in the Swedish Mission, all to no purpose. It almost appeared that it was impossible to treat this fibre in any of the machines used for most of the other fibres of the same type. At the same time I strongly suspected that, the machine being only semi-automatic, a great deal more skill was needed on the part of the operator.

Whilst at home on leave in 1927, I happened to visit the works of Messrs. Robert Boby, St. Andrews Works Bury, St. Edmunds, in connection with the inspection of some grain grading and cleaning machinery. I was very struck by some very fine scutching that I saw being performed at these works, on a Boby—Soenens Scutching machine, I mentioned the subject of Sann hemp, and was informed by the firm that they would be only too pleased to arrange for some of their staff very experienced in this work to experiment with sann hemp. On my return to India therefore, I ordered some bales of good retted straw, baled in a grass press, to be sent to Bury St. Edmunds, from Chhindwara.

As another firm, Messrs. Marshall Sons and Company, Limited, of Gainsborough, had also shown great interest in our work, and had supplied us with the first machine, bales of the same dry retted straw, were sent to them, with the request that they would try to deal with the

straw on their Automatic scutcher, with the aid of a really able experienced operator.

Reports were duly received. Messrs. Bobby's had ill fortune. The bales arrived in very poor condition, in a semi-rotting state, and their machine could do nothing with the straw. It was indeed doubtful if the Bobby-Soenens machine, would ever do for sann, being designed almost exclusively for flax, on which fibre it produced very remarkable results.

Messrs. Marshalls' fared better. This firm like Messrs. Bobby's complained of the very poor quality of the baled straw. They, however, were able to produce three very excellent samples, and some very valuable figures. Cleaned high quality fibre was produced at 10 lbs. per hour, tow a little less. A third sample of a very passable quality of fibre, was produced by simply passing the straw through a Six Pair Breaker, and shaking it. This third sample was produced at about 1¼ ton per hour.

The firm's own report is attached. A.

It would appear therefore that it is not impossible to treat sann hemp successfully with modern machinery.

The samples were sent from Gainsborough without any comments as to their "trade" value. This was only to be expected, as it was not part of the arrangement. I then made an attempt to get the samples valued from a trade point of view. It was not found possible to get the samples valued. The Industries Department, Bombay merchants, and all possible avenues were explored, without results. Finally the samples were sent to Messrs. The Shalimar Rope Works, Limited, Calcutta. This firm were not able to get a valuation, and attempted to make rope of the best sample, which was destroyed in doing so, as the fibre was not that to which the firm were accustomed. The other samples were returned to me, and the matter had to be dropped for that year.

Later, in the next year, I made arrangements, and issued instructions for the supply of more baled dry retted straw to Messrs. Marshall, through their Bombay Branch, and arrangements were made for the fibre produced to be sent to the Imperial Institute for valuation.

The report of the Imperial Institute is attached. B.

On this occasion the firm were not tied down to the type of machine to be used, and have very strongly advised us to use a "Drum Dresser" in preference to any other type of scutching machine, in view of the lack of skilled labour. The cost of such a machine is Rs. 957 and it is not anticipated that a suitable oil engine to drive it would cost more than Rs. 800. A "blue print", of the machine is attached (not printed).

Owing to the financial troubles of the Central Provinces, it has not been possible to give this machine a trial in this country, and therefore as regards scutching, it has not been possible to proceed any further.

Straw.—Throughout the correspondence on this subject with home firms, who have been good enough to try to deal with sann fibre, by machinery, one fact is outstanding, and that is the very poor quality of the straw. The firms always mentioned it. They attribute this to bad retting. Retting can be bad in two ways only, generally speaking. Sann can be over retted or under retted, that is the period of retting

has to be studied. This has been done, and it has been found to vary with the temperature of the retting water, from about 6—8 days,—six days in the hot weather and 8 in the cold. The soil where the crop is grown also has some effect, the lighter soils producing the lighter coloured fibres. The general tendency is to over ret.

The main criticism, however, was directed against the foul state of the straw. It was dirty and dusty. This is due to retting in dirty stagnant water, or little more than puddles. Mr. Sabnis, who visited this District in 1931, was able to see retting going on in muddy pools in the various tributaries of the Nerbudda River in Jubbulpore and Mandla Districts. The harvested sann is tied up in bundles rather like sheaves, and these are laid in the pools or river channel. If there is a small current flowing, these bundles are weighted down with stones.

In 1931 I decided to make some trials to obtain a better quality straw. Clean water was necessary, and as this had to be under departmental control, it was considered that the Ratona Section of the Saugor Farm would be most suitable. The land is well drained, and the rainfall light, and the irrigation tank offers a large volume of clear water. The boom system or float system was used, a system used in South Africa, and other countries, where retting is done in running water, in big rivers. The harvested sann was tied in bundles, and the bundles were tied together in booms, rafts or floats. These were sunk to just below the surface in 15' of clean water being anchored to prevent them drifting. Daily registers of the temperature of the water were kept, and booms were retted for various periods. On the completion of the retting period each boom was towed ashore, and was landed, broken up, and stacked in the ordinary way for drying, on the stone facing of the tank bund, to keep it free from dust or mud.

The dried straw was then very carefully scutched by hand. The fibre was collected in lots, each lot being produced for a retting period. The experiments are still going on, and there are now a good many samples awaiting valuation.

I cannot too strongly urge the necessity for a readily available and competent trade opinion on this type of fibre in India. It is only in the final stage, that the Imperial Institute need be called in.

At present matters are held up, for lack of such an opinion. Such results as I have are for general purposes a meaningless mass of figures, whilst the end in view is the commercial value of the fibre, and its comparison with that of other countries.

Finally if India is to establish herself on the market as a source for the supply of good quality hemp fibre, it will be necessary to see that the grower gets a fair share of the increase in the value of the crop. The grower is usually responsible for the retting, and in many cases the scutching also. There is no indication that the fibre from a very heavy luxuriant crop is any better than that from a normal crop. The probability is that it is weaker. Increasing the acreage outturn of green sann or straw for fibre, is fraught with danger. The heavy luxuriant, succulent crop is an advantage as a green manure, but not as a producer of good quality fibre.

If machine scutching can be introduced, the improvement in retting will be the greatest necessity. For retting the cultivator is responsible, and unless a fair share of the premium offered for better quality fibre can be guaranteed to him, he will do nothing, and the opportunity will be lost. Nor can he afford to wait for his money.

It is feared that nothing will be done unless the Department of Agriculture is permitted to set the ball rolling on a very small scale.

E. A. H. CHURCHILL,

Deputy Director of Agriculture,

C. P. and Berar, Northern Circle.

25th November, 1933.

A.

COPY OF LETTER FROM MESSRS. MARSHALL SONS AND CO. (INDIA), LTD., BALLARD ROAD, BOMBAY, TO THE DEPUTY DIRECTOR OF AGRICULTURE, NORTHERN CIRCLE, JUBBULPORE, C. P., No. R.F.G., DATED THE 11TH MARCH 1929.

We refer you to our letter R.F.G. 19553, of the 4th October 1928, wherein we advised you that we were sending the two sample bales of sann hemp straw to Messrs. Marshalls, Gainsborough. We have now before us their report, giving results of tests carried out by them, which reads as follows :—

“ When the two bales of sann hemp were opened out, the straw was found to be in bad condition. In transit, the bales had either been exposed to rain for a considerable period or had been dropped in the dock.

Where the straw had been bent over to aid packing the fibre had again retted and rotted through, so a considerable bulk of the straw was of very short length. However with careful sorting and slow drying we have been able to secure sufficient straw from the centres of the bales to allow us to run the tests through.

Tests.

The sample “ A ” of scutched fibre has been subject to the following treatment :—

It was first passed through the Marshall 6 Pair Flax Breaker and then scutched on the Marshall Flax Scutcher. The breaking machine was set with practically no tension on the rop roller springs.

As regards the scutcher we discovered by previous tests that only half the blades were necessary so we removed the 4 steel blades in each drum, leaving only the 4 wood blades which were quite sufficient. Except for this the operation was standard.

When the straw was taken off the breaking machine and stricked ready for scutching its weight was only 20 per cent. of the original weight. That is to say 80 per cent. of woody core was taken out in the breaking operation alone.

The figures for sample "A" (scutched fibre) and for sample "B" (Tow) are as follows :—

Weight of straw	..	..	56 lbs.
Weight of broken straw	..	..	11½ lbs.
Weight of scutched fibre	..	..	3 lbs. 6 oz.
Weight of scutched tow	..	..	2 lbs. 2 oz.
Yield of finished fibre	..	..	6 per cent.
Yield of tow	..	..	3.8 per cent.
Time taken in scutching	..	..	20 minutes.
Bute 10 lbs. Finished fibre per hour.			

The sample 'B' is of the Tow referred to above and was treated when gathered from the scutcher as by ordinary hand mill.

The sample 'C' has not been scutched. This sample was prepared as follows :—

A quantity of the short and bruised straw was gathered from the outside of the bales and was passed through the Marshall Breaker and then shaken out by hand, this operation being performed twice, beyond this it has received no other treatment. Of course the result is not real clean but it shows an yield of 16½ per cent. and considering the very poor quality of the straw we thought it might interest you to see this sample as our breaking machine is capable of treating about ¼ ton of similar straw per hour. Apart from removing most of the woody core our breaking machine has a softening effect on the fibre."

We hope the foregoing will be useful to you.

Always with pleasure at your service.

We are, etc.

True Copy.

B.

Copy.

F. 1540/18.

Imperial Institute,
South Kensington,
London, S. W.-7.

REPORT ON SANN HEMP AND TOW PREPARED FROM RETTED STALKS.

The samples which are the subject of this report were forwarded to the Imperial Institute by Messrs. Marshall Sons and Co., Ltd., of Gainsborough who had prepared them from retted Sann straw supplied by the officiating Director of Agriculture at Jubbulpore. The firm had been requested to treat the straw for the extraction of fibre by their machinery and to submit the resulting products to the Imperial Institute for examination.

The subject was also referred to in a letter to the Imperial Institute dated 14th November 1930 from the Indian Trade Commissioner in London,

who asked to be supplied with a report on the results of the examination of the material.

Messrs. Marshall stated that after carrying out trials with various machines they had found that the best results were obtained by treating the dry straw with their 6 Pair Breaker and an Irish Scutch Wheel. The breaker removed 75 per cent. of shieve quite free from fibre or tow; the shieve remaining on the fibre after this operation was removed by treatment over the scutch wheel.

The best yields obtained from the original dry straw were $18\frac{1}{2}$ per cent. of finished fibre and $5\frac{1}{2}$ per cent. of tow. The firm expressed the opinion that for practical operations in India a drum dresser would be preferable to the scutch wheel, as it would not necessitate any skilled labour and would furnish a larger output per hour.

Description.

Fibre.—Weight 50 lbs.

This was a fairly fine, lustrous, pale yellowish-brown fibre, which had been fairly well separated and freed from woody matter. The strength was good. The length varied from 4 to 6 feet, being mostly from $4\frac{1}{2}$ to 5 feet.

Tow.—Weight 18 lbs.

This consisted of short, tangled fibre, of good strength and similar character and appearance to that described above. The strands measured up to $2\frac{1}{2}$ feet but were mostly from 1 to $1\frac{1}{2}$ feet in length.

Results of Examination.

A representative portion of the fibre was chemically examined with the following results :—

			<i>Per cent.</i>
Moisture	..	..	.. 9.3
Expressed on the moisture free fibre.	{ Ash	..	.. 0.9
	{ a—Hydrolysis, Loss	..	.. 12.9
	{ b—Hydrolysis, Loss	..	.. 21.9
	{ Water-washing, Loss	..	.. 5.1
	{ Cellulose	..	.. 78.4

The material suffered higher losses on water-washing and hydrolysis, and contained rather less cellulose, than some of the samples of well cleaned and prepared sann hemp previously examined at the Imperial Institute. The high loss on water-washing may be attributed to the fibre not having been adequately freed from gum.

Commercial Value.

The fibre and tow were submitted to a firm of merchants in London (Messrs. Wigglesworth and Co., Ltd.), who furnished the following report :—

The results of the present experiment may be considered satisfactory. The fibre is glossy and sufficiently well cleaned to be marketable; it has good strength, and although slightly broken, this defect could no doubt be remedied by adopting Messrs. Marshall's suggestion for the treatment on drum instead of the Irish Scutching blades, which are obviously too severe

on fibre of this class. We consider the fibre an improvement on even the best of the hand-prepared fibre shipped from India.

The tow produced is clean and fairly long, and would compare favourably with Russian or Hungarian tow, although rather more brittle, as is usual with Indian *Crotalaria* fibre.

We value the long fibre at £22 and the tow at £16 per ton.

It should be noted that values to-day are exceptionally low. Fine Jubbulpore selling at £13 10s. and Fine Dewghuddy, which is regarded as the best type of Indian Hemp, at £19 per ton. It can be seen, therefore, that this experiment is of considerable interest, and we would recommend a continuation in India, on the spot where the material is produced, by the shipping of a unit of machinery, as offered by Messrs. Marshall. It would however be advisable, before sending the drum machine, that some fibre should be passed through it in order to see if the result is satisfactory.

Remarks.

It will be seen from the foregoing results that fibre and tow of good quality have been produced by the treatment of dry, retted sann hemp stalks in the experiments conducted by Messrs. Marshall and Co. It would therefore appear desirable for the firm to be supplied with a further consignment of the retted straw in order to carry out their suggested treatment with a drum dresser, and, should the results be favourable, eventually to make arrangements with the firm for suitable machinery to be forwarded to India for the purpose of practical trials on a commercial scale.

If so desired, the Imperial Institute will be glad to receive for examination samples of any fibres which may be produced in the course of such trials.

True copy.

APPENDIX LVI.

NOTE, DATED THE 26TH JULY 1934, ON SUBJECT NOS. 50, 51 AND 52 :

A. APPLICATION FROM THE GOVERNMENT OF MADRAS, FOR A GRANT OF RS. 1,500 SPREAD OVER THREE YEARS FOR A SCHEME OF EXPERIMENTS FOR THE IMPROVEMENT OF SUNN-HEMP FIBRE AT THE AGRICULTURAL RESEARCH STATION, SAMALKOTA. B. APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF RS. 1,500 SPREAD OVER THREE YEARS FOR RESEARCH WORK ON SUNN-HEMP IN THE BOMBAY PRESIDENCY. C. APPLICATION FROM THE GOVERNMENT OF THE CENTRAL PROVINCES FOR A GRANT OF RS. 20,060 SPREAD OVER FIVE YEARS FOR A SCHEME OF RESEARCH WORK ON SUNN-HEMP IN THE CENTRAL PROVINCES.

Attention is invited to the attached note dated the 22nd January 1934 (Encls. I) on the subject mentioned above. The schemes were considered by the Advisory Board at its meeting held in February 1934 but it was decided, *vide* extracts from the proceedings of the Board (Encls. II) that they might be referred to an *ad hoc* Committee to be appointed by the Chairman of the Board. The Vice Chairman to the Council has accordingly appointed the undermentioned Committee for the purpose :—

- (1) The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
- (2) The Agricultural Expert, Imperial Council of Agricultural Research.
- (3) The Director of Agriculture, Madras.
- (4) The Director of Agriculture, Bombay.
- (5) The Director of Agriculture, Bengal.
- (6) The Director of Agriculture, United Provinces.
- (7) The Director of Agriculture, Bihar and Orissa.
- (8) The Director of Agriculture, Central Provinces.
- (9) Mr. T. S. Sabnis (subject to the approval of the United Provinces Government).

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio*.

2. The Committee will meet on an afternoon between the 3rd and the 8th September 1934 which will be fixed to meet the convenience of members. The report of the Committee will be circulated to the Advisory Board in due course.

3. With reference to the last sentence of Encls. II, the Director of Agriculture, Bengal, has intimated that no sunn-hemp scheme will be submitted by the Bengal Department of Agriculture as the work is being undertaken from provincial funds.

ENCLO I.

NOTE DATED THE 22nd JANUARY 1934, FOR THE NINTH MEETING OF THE ADVISORY BOARD, FEBRUARY 1934. (SUBJECT No. 29.)

- A. APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF Rs. 1,500 SPREAD OVER THREE YEARS FOR A SCHEME OF EXPERIMENTS FOR THE IMPROVEMENT OF SUNN-HEMP FIBRE AT THE AGRICULTURAL RESEARCH STATION, SAMALKOTA.
- B. APPLICATION FROM THE GOVERNMENT OF BOMBAY FOR A GRANT OF Rs. 1,500 SPREAD OVER THREE YEARS FOR RESEARCH WORK ON SUNN-HEMP IN THE BOMBAY PRESIDENCY.
- C. APPLICATION FROM THE GOVERNMENT OF THE CENTRAL PROVINCES FOR A GRANT OF Rs. 20,060 SPREAD OVER FIVE YEARS FOR A SCHEME OF RESEARCH WORK ON SUNN-HEMP IN THE CENTRAL PROVINCES.

Attention is invited to the attached letter (Annexure I) No. F-137/33-A., dated the 29th June 1933, addressed by the Secretariat of the Council to the Departments of Agriculture in Madras, Bombay, Bengal, United Provinces, Bihar and Orissa and the Central Provinces, regarding the recommendations contained in the Report on Hemp Marketing in India by Mr. T. S. Sabnis. As a result of this, applications for grants for research work on sunn-hemp have now been received from the Governments of Madras, Bombay and the Central Provinces. A copy of each of these schemes will be found in Annexures II to IV. The Madras and Bombay schemes involve so far as the Council is concerned, an expenditure of Rs. 1,500 each, spread over three years while the Central Provinces scheme is for a period of five years and involves a non-recurring expenditure of Rs. 10,000 and a recurring expenditure of Rs. 10,060 or a total of Rs. 20,060 spread over the five-year period. The three schemes have been approved by the respective provincial Research Committee and the local Governments. In the case of the scheme from the Government of Madras, the local Government have definitely stated that their scheme is not one which they would be prepared to undertake at their own cost.

2. The three schemes are now for the consideration of the Advisory Board. In this connection it may be stated that at its meeting held in August 1933, the Advisory Board recommended an application from the Government of the United Provinces for a grant for research work on sunn-hemp in that province at a slightly reduced cost; this scheme has since been approved by the Governing Body and is at present awaiting the allotment of funds.

ANNEXURE I.

COPY OF LETTER NO. F-137/33-A., DATED THE 29TH JUNE 1933, FROM THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO THE DIRECTORS OF AGRICULTURE, MADRAS, BOMBAY, BENGAL, UNITED PROVINCES, BIHAR AND ORISSA, AND THE CENTRAL PROVINCES.

Recommendations contained in the report on Hemp Marketing in India by Mr. T. S. Sabnis.

I am directed to say that Mr. T. S. Sabnis, who was appointed by the Imperial Council of Agricultural Research to conduct an enquiry into the problem of hemp marketing in India, in the course of his Report, recommended *inter alia*, that :—

- (1) The advantages of driving the harvested crops as practised in Ratnagiri district (Bombay Presidency) should be investigated. (Paras. 71 and 82).

- (2) Instructions should be given to cultivators regarding the proper time and method of harvesting, retting and extraction of fibre and efforts should be made to improve facilities for washing the fibre where these are deficient (Paras. 11, 15, 29, 36, 45, 53, 71, 83, and 85).
- (3) The vertical and twisting actions of the retted bundles during washing as practised in the United Provinces (Para. 15) and beating of the retted material during extraction as practised in some parts of Bengal (para. 45) are undesirable (para. 83).
- (4) The practicability of improving the quality of sunn-hemp fibre by 'sweating' should be investigated (para. 84).
- (5) The practice of leaving sticks and dirt in the fibre and of twisting it tightly into bunks which serve to hide 'loading' should be discouraged (paras. 16, 86).
- (6) It is desirable to study the effects of the season of growth, and of harvesting and retting practices on the fibre with a view to improvements (para. 87).

2. An *ad hoc* Committee appointed by the Imperial Council examined these recommendations and came to the conclusion that before any action could be taken on the above recommendations, investigations would be necessary in the provinces concerned. In this connection the question of having the work carried out at some central station was raised and the possibilities of the Harcourt Butler Technological Institute at Cawnpore were considered. The advantage claimed for a central station was that accurately controlled experiments could be conducted under the supervision of a skilled technologist who could also be employed to carry out tests on strength and quality of fibre. The results obtained at the Central Station would then be applied in the provinces with suitable modifications for local conditions. But the scheme of research at a central station was not favoured in present financial circumstances and it was decided that the investigations should be limited to the removal of specific defects pointed out by Mr. Subnis in the matter of growing, harvesting and retting of the crop. It was also suggested that the Directors of Agriculture might arrange for experiments with the object of obtaining quickly results which would help the growers to produce fibre which would be cleaner and more suitable for the ultimate use to which it would be put. It was also agreed that the Provinces concerned might each be offered a small grant of say, Rs. 500 per annum for a maximum period of three years for carrying out more urgent experiments and that if any tests, in the United Kingdom, were found necessary, the cost of these should be met by the Council.

I am to add that should you consider it necessary, an application for a grant from the Council, for carrying out the necessary tests, etc., in this, may please be made in the usual way.

ANNEXURE II.

SCHEME OF EXPERIMENTS FOR THE IMPROVEMENT OF SUNN-HEMP FIBRE AT THE AGRICULTURAL RESEARCH STATION, SAMALKOTA (MADRAS).

Sunn-hemp is grown in circles in summer months as well as in winter months. The summer grown crop is used either for fibre or for manure while the winter sown one for fodder or for manure. In June-July it is grown in dry lands as a mixed crop with dry paddy, cotton and red-gram for seed purposes. The summer crop generally comes up well without much damage being done by insects but the winter sown one is largely damaged by insect pests particularly *Utethesia pulchella* and as such the pest has got to be controlled if the experimental work is to be continued with the cold weather crop as well.

As it is not possible to take up fresh area due to the smallness of allotment an area of 3 acres from the farm land is proposed and the cropping will be fitted into the existing rotation.

As the final product required is only fibre, experiments relevant to the purpose are proposed in the following paragraphs.

1. *Collection and trial of varieties.*—Improvement of varieties or strains by selection is beyond the scope of this scheme. A large number of varieties will, however, be collected from different parts of the Province and tested for their fibre yielding capacity. The large seeded types are considered to give fibre of superior quality.

2. *Effect of seed rate on fibre content.*—Sparse stand induces branching of stem, which is not a desirable feature in fibre extraction while very thick stand is reported to be responsible for weak fibre. Seed-rates of 30, 50, 60, 70, 80, 100 pounds to the acre will be tried with the best yielding types with a view to arrive at the optimum seed rate required for procuring fibre of best quality and quantity.

3. *Seasonal planting.*—The crop will be grown in all possible seasons to see in which part of the year the weather conditions are not favourable for the successful production of fibre.

4. *Influence of soil on fibre content.*—Produce from lighter soils is considered fine, white and strong, while that obtained from heavier soil is comparatively coarse, dull-white and weak for the same variety. The crop will be grown on light medium and heavy soils to see their bearing on the quality and quantity of fibre.

5. *Fibre in relation to depth of soil.*—Good surface tilth is considered sufficient while deep ploughing is deemed unsuitable. This has got to be verified.

6. *Effect of manures.*—Heavy manuring especially with nitrogenous manures is considered not desirable while moderate doses of the same are said to give best results. The effect of phosphatic manures on the fineness and strength of fibre will also be ascertained.

7. *Effect of Irrigation.*—Under dry conditions, fine and strong fibre is said to be obtained while irrigated conditions favour coarseness. The veracity of this belief has got to be verified.

8. *Effect of continuous cropping.*—Continuous cropping may have some deteriorating effect on the fibre content.

9. *Harvesting trials.*—(i) Harvesting of stalks.

- (a) before flowering ;
- (b) after flowering ;
- (c) before setting of seed ;
- (d) after setting but before ripening of seed ;
- (e) after ripening of seed.

It is believed that best colour and fineness are obtained when the crop is harvested before the seed sets and best combination of strength, colour and fineness is obtained if the crop is harvested just before the seed is ripe. When the seed is ripe, the fibre loses colour and fineness but gets stronger.

(ii) *Pulling versus cutting.*—In some places, the stalks are pulled out and retted while in others they are cut to ground level for retting. Differences in the quality and quantity of fibre due to this differential treatment will be noted.

10. *Treatment after harvest.*—(i) Grading of stems according to size to see whether it makes any material difference in the quality of sample obtained.

(ii) Drying as against non-drying of stalks before retting.

(iii) Cutting of roots and tops (a) before drying (b) after drying (c) not cutting at all.

11. (i) Optimum period of retting to get best quality fibre.
- (ii) Complete immersion as against butts first and then the whole stalk.
- (iii) Retting in stagnant water *versus* in running water.

12. *Washing and Cleaning*.—(i) Washing retted bundles as against extracted fibre.

(ii) Beating wet fibre as against dry fibre.

13. *Extraction*.—(i) Dry *versus* wet extraction.

(ii) Single stalk extraction *versus* small bundle extraction.

14. *Drying*.—Drying in shade *versus* drying in sun.

15. *Sweating*.—(i) Sweating *versus* non-sweating.

(ii) Sweating of extracted fibre as against retted material.

Area proposed.—As aforesaid already an area of 3 acres will be allotted for the purpose. F. Nos. 1 *a* and *b* are lighter in texture.

Nature of experiments.—All the field experiments will be laid out on the Fisher's Lating square or randomised block method and there will be sufficient number of samples taken in other cases to give fairly accurate data.

Retting.—Retting will be done in the channel west of field numbers 17 to 22 and provision is made for a cement tub for retting and cleaning in well water.

Drying and sweating.—An amount of Rs. 55 is provided for a shed for the purpose.

Staff.—The work will be managed with the present staff of the station and provision is made only for some literate assistance during the period.

Receipts—

	Rs.
By sale of fibre—3 candies at Rs. 50 each per year ..	150
Receipts for three years	450 450-0-0

Expenditure.—As some items of work are of a non-recurring type and expenditure on these has to be undertaken at the very start an amount of Rs. 650 may be allotted in the 1st year and the balance of Rs. 850 equally in the other two years.

Details are given below :—

(a) *Non-recurring expenditure—*

	Rs.	a.	p.
(1) One cement tub 20' \times 6' \times 3' at Re. 1 a sq. ft. of plinth with a leading channel	130	0	0
(2) One thatched shed 30' \times 15' at 2 as. a sq. ft.	55	0	0
(3) One Picottah for the dry land plot	30	0	0
(4) One dozen sickles	5	0	0
(5) Mallets, Wooden planks, etc.	5	0	0
Total	225	0	0

(b) *Recurring expenditure per year—*

1. *Supervision—*

Literate assistance in Experimental work at Rs. 20 per mensem	240 0 0
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	Rs.	a	p.
<i>2. Cultivation expenses per acre—</i>			
Preparatory cultivation—3 ploughings	5	0 0
Seed and sowing at 65 lb. at 1 anna a lb...	..	5	0 0
Manure—compost	3	0 0
Harvesting, retting preparation of fibre, etc.	..	42	0 0
		<hr/>	<hr/>
		55	0 0
		<hr/>	<hr/>
For three acres at Rs. 55	165	0 0
<i>3. Miscellaneous charges—</i>			
Insect pests, control, etc.	10	0 0
Ry. freight on seed, sample fibre, etc.	10	0 0
		<hr/>	<hr/>
Total	425	0 0
		<hr/>	<hr/>
Recurring expenditure for three years	1,275	0 0
		<hr/>	<hr/>
GRAND TOTAL	1,500	0 0
		<hr/>	<hr/>

ANNEXURE III.

LETTER FROM MR. V. V. GADGIL, DEPUTY DIRECTOR OF AGRICULTURE, SOUTH CENTRAL DIVISION, POONA, TO THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, No. 5989 OF 1933, DATED THE 18TH NOVEMBER 1933.

With reference to your letter No. 839, dated the 15th November 1933, I have the honour to submit herewith the Scheme for investigations of problems in Sunn-Hemp cultivation in Ratnagiri District, for putting the same before the Bombay Provincial Agricultural Research Committee and the Imperial Council of Agricultural Research, for approval and sanctioning an yearly grant of Rs. 500 for a period of three years. I have not included the cost of Establishment, in this Scheme, as the Imperial Council of Agricultural Research has clearly mentioned in their letter No. F.137-33A., dated 29th June 1933, that the Imperial Government will offer only a small grant of Rs. 500 per annum for a period of three years, for carrying out most urgent experiments to each Province concerned.

Application to the Imperial Council of Agricultural Research for a Grant-in-aid of Rs. 500 per annum for a period of three years.

The Devgad and Rajapur Talukas in the Ratnagiri District of the Bombay Presidency grow the best quality of Sunn-hemp fibre in the whole of India. Besides this is the only money crop here. The whole of the land revenue of these two talukas was equivalent to the prices realised from this crop before the present slump, worth about Rs. 3—4 laes. Mr. T. S. Sabnis, Hemp Marketing Officer appointed by the Imperial Council of Agricultural Research, had visited in 1931 important centres of cultivation and has made some valuable suggestions regarding improvement in the cultivation of this crop. The tract where at present this crop is taken is rocky, full of hills and there is very little of level land where any crops of importance can be taken. Under the circumstances it is well worth to encourage this cultivation by bringing to the notice of the agriculturists that the area, quality and quantity of this crop can be greatly increased and thereby a substantial increase in

their outcome can be brought about. The Imperial Council of Agricultural Research have also decided to investigate the recommendations of Mr. T. S. Sabnis. In addition to the above recommendations it is requested that some other problems as given below may also be tackled in order to increase the area under the crop as well as to improve the quality and quantity of the hemp fibre.

The chief objects of this scheme are in brief :

- (1) To study the possibility of an increase in the present area under this crop.
- (2) To see if the present yields of fibre per acre can be increased.
- (3) To find out whether the quality of the fibre can be improved.
- (4) To study the possibility of producing the seed locally instead of importing it every year from Gujarat. If the scheme is properly worked out it will greatly help to solve the various problems before the cultivators of this tract. The detailed items of investigation will be :—
 - (1) To see if the present practice of burning the land before sowing can be done away with by use of sulphate of ammonia and thus make it possible to increase the area under this crop.
 - (2) To find out whether higher yields would be obtained by (a) sowing the crop in June instead of in August as is done at present and also (b) by using different seed rates.
 - (3) To see if the seed required can be locally grown instead of importing it from distant places in Gujarat.
 - (4) To study whether the quality of fibre can be improved by :—
 - (a) harvesting the crops earlier, and also,
 - (b) by changing the periods required for rotting as well as,
 - (c) by cutting the roots of the crop.

It is proposed to conduct these trials except item No. 3 at two suitable centres one in each of the Rajapur and Devgad Talukas. The raising of san seed will be done at Chiplun.

Expenditure.

	Rs.
Cost of cultivation on 4 acres at Rs. 100 per acre for raising san for fibre in the Rajapur and Devgad talukas	400
Cost of cultivation of san for seed at Chiplun on one acre	30
Supervision charges at Rajapur where there is no Departmental man to look after the crops ..	25
Wages of a watchman at 2 places for about 1½ months from harvesting till end	25
Miscellaneous	20
Total ..	500

It is estimated that about 1,700 lbs. of fibre and 400 lbs. of seed will be the yields per annum worth Rs. 170 at the present low prices.

(Sd.) V. V. GADGIL,
Deputy Director of Agriculture,
South Central Division, Poona.

ANNEXURE IV.

Research scheme on Sann Hemp in the Central Provinces.

Sann hemp is next to jute and cocoanut, the most important fibre crop in India and it is certain that India could obtain a larger share of the trade with the United Kingdom if more attention were paid to the better marketing of the crop. The Imperial Council of Agricultural Research has already done something to bring this aspect to the notice of the provinces where the crop is of importance. India had a golden opportunity to capture the English market when Russian hemp was temporarily out of the market but unfortunately this was not taken advantage of. It may now be uphill work to supplant Russian hemp in the English market but any improvement in the crop will redound to the benefit of the grower and for this reason alone is worth attempting. The Central Provinces is particularly interested in the betterment of the crop—both agriculturally and commercially, firstly because the Central Provinces grows a very large area of Sann and secondly because certain grades of Central Provinces hemp are well known in the market and fetch special premia over hems grown in most other parts of India.

In the agricultural year ending 31st May 1932 the total area of fibre crops in the Central Provinces and Berar was 95,138 acres. This is composed mainly of sann (*Crotalaria juncea*). The only other fibre crop of any importance is *ambadi* (*Hibiscus cannabinus*) which is grown sometimes on the "bunds" of rice fields and mixed with tur (*Cajanus indicus*) to divide the plants in the cotton fields. *Ambadi* is grown entirely for domestic use and its area is not calculated so that the figure given above may be taken as wholly "sann".

Spasmodic attempts have been made by the Central Provinces Department of Agriculture in the past to improve the retting and presentation of samples of sann hemp for valuation and sale but much more intensive work is necessary if the fibre is to take the place it should as one of the exportable commodities of India. Unfortunately the Department cannot spare the special staff necessary to do this work more thoroughly and hence this appeal for funds from the Imperial Council of Agricultural Research.

The main complaints regarding Indian hemp in the London market are—(1) its dirty condition and (2) its lack of uniformity. Spinners, in England have been compelled by law to instal special machinery to deal with dirty raw products and it is therefore understandable why sann hemp is not popular with the manufacturers. Italian and Russian hemp do not require special treatment and they have therefore a special advantage over "sann". The Seoni and Itarsi grades of Central Provinces sann hemp are much sought after by buyers because of their greater cleanliness. Sann is usually retted in stagnant pools or tanks and the grower believes that the more mud that adheres to it, the more money he obtains for it. In Seoni and Betul districts, sann is retted in running water—usually in a stream or river—and no mud and dirt adhere to the fibre which accounts for the enhanced price for samples from these districts.

The first essential in dealing with sann hemp is to find out the best method of retting it and experiments will have to be carried out with this end in view. Some work has already been done. It is proposed to construct small pucca retting tanks and to study the optimum conditions for retting with special reference to the temperature of the water and its bacteriological content.

The department has a scutching machine which however, has not been an unqualified success. Other machines—worked by hand and by small oil engines—need to be tried and provision is being made for them in the scheme.

There is great scope for work in the preparation of the fibre for the market. Experiments are necessary to find out the losses incidental to hackling, scutching and other methods of cleaning the fibre. This is one of the commercial aspects of the investigation.

On the agricultural side, the botany of the crop requires working up. Nothing has been done in the Central Provinces to isolate and test the component races which comprise the commercial crop. There is a virgin field ready for the worker.

In order to carry out the work briefly outlined above, I estimate the following grant will be necessary :—

	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. The Botanical Assistant on Rs. 70—70—75—80—85	840	840	900	960	1,020	4,560
2. Travelling allowance ..	300	300	300	300	300	1,500
3. Contingencies ..	800	800	800	800	800	4,000
4. Non-recurring expenditure for machinery and retting tanks ..	10,000	..	..	..	..	10,000
Total ..	11,940	1,940	2,000	2,060	2,120	20,060

The Central Provinces Government will provide all the land and laboratory accommodation required for carrying out the research which will be carried out by the Agricultural Chemist.

ENCLO. II.

Extracts from the proceedings of the Advisory Board, February 1934.

- (i) Application from the Government of Madras for a grant of Rs. 1,500 spread over three years for a scheme of experiments for the improvement of sann hemp fibre at the Agricultural Research Station, Samalkota.
- (ii) Application from the Government of Bombay for a grant of Rs. 1,500 spread over three years for a scheme for research work on sann hemp in the Bombay Presidency.
- (iii) Application from the Government of the Central Provinces for a grant of Rs. 20,060 spread over 5 years for a scheme of research work on sann hemp in the Central Provinces.

(Subject No. 29 of the Agenda.)

Mr. Burt in introducing the subject, explained that the schemes were the outcome of the discussion by the Board of Mr. T. S. Sabnis' report on the Hemp Marketing in India. He proposed that before the Board considered the schemes, they might be referred to an *ad hoc* Committee to be appointed by the Chairman to meet at or before the next meeting of the Advisory Board. The proposal was carried. Mr. Maclean proposed to submit the Bengal proposal by about the middle of May.

APPENDIX LVII.

REPORT OF THE SUB-COMMITTEE ON ' CEREAL RUSTS ' SCHEME.

Present :

Diwan Bahadur Sir T. Vijayaraghavacharya (Chairman).

Dr. S. P. Agharkar.

Dr. W. Burns.

Mr. B. C. Burt.

Khan Bahadur Maulvi Fateh-ud-Din.

Mr. V. N. Likhite.

Dr. K. C. Mehta.

Prof. J. H. Mitter.

Dr. B. P. Pal.

Prof. P. K. Parija.

Mr. P. B. Richards.

J. H. Ritchie.

Mr T. S. Sabnis.

Mr. D. R. Sethi.

Dr. F. J. F. Shaw.

*Progress report on the investigations on ' cereal rusts ' by Dr. K. C. Mehta for the year 1933-34 (Subject No. 56, Appendix LVIII).—*The progress report was approved. The sub-committee desires to report to the Advisory Board that every satisfactory work is being done on this scheme.

*Programme of work for 1934-35 (progress report, page 5).—*The sub-Committee notes that the Crop Botanist, Bombay Presidency, has a number of crosses of *khapli* with other wheats and suggests that these might be tested for rust-resistance with advantage. Dr. Mehta has agreed to test these with single spore cultures of the different physiologic forms of rust. It was also explained that item 7 of the programme includes a continuance of the study of the possibility of over-summering of rusts in certain favourable areas. The sub-committee is of opinion that there is now sufficient knowledge of the physiologic forms of the three rusts to enable breeding work for the production of resistant varieties to be started with a reasonable prospect of success. This is dealt with in the extension scheme. The programme of work was approved.

*Application from the Government of the United Provinces for a grant of Rs. 1,24,000 for the continuance of the investigations on cereal rusts by Dr. K. C. Mehta, Professor of Botany, Agra College, for a further period of three years from April 1935 (Appendix LIX).—*The Sub-Committee strongly recommends the continuance of this scheme of work which has led to important results. Some minor modifications are referred to below :—

Items 1 to 5 of the programme of work are approved. Item No. 6 can now be omitted as arrangements have since been made for co-operation.

between the Imperial Economic Botanist and the Rust Research Laboratory in the breeding of resistant varieties. Details of the proposed arrangement are attached. The Sub-Committee also considers that item 7—the comparative study of the investigations on cereal rusts in other countries should be omitted. In regard to item 8 of the programme, the Sub-Committee approves of this work and the Directors of Agriculture concerned have agreed to co-operation by their departments in the manner suggested but the Director, Imperial Institute of Agricultural Research, has offered assistance from the Mycological Section of the Institute which will substantially reduce the cost.

The financial details of the scheme are approved with the following modifications :—

1. *Establishment*.—The Assistant for meteorological work will be required for 9 months making an annual charge of Rs. 675. On the other hand, the scales of pay of Assistants have been revised in the manner suggested by the United Provinces Research Committee so that there is a small net saving on the establishment amounting to Rs. 1,545 in the three years of which Rs. 545 is required for a small change in contingent charges.

II. *Equipment*.—Equipment will now be reduced to Rs. 7,200 as the Council has been able to allot Rs. 1,800 for an urgent item during the current year.

III. *Maintenance and contingent expenses*.—The revised figures under this head are :—

1935-36	..	..	..	..	4,147
1936-37	..	..	..	..	4,000
1937-38	..	..	..	..	4,000

The change has been due mainly to increased charges for electric current.

Item VIII (Visit to U. S. A., Canada and Europe) can be omitted entirely as the corresponding item of the programme has been omitted.

Item X (for place to place survey of oversummering of rusts and their incidence on crops in the Punjab, Bombay-Deccan and Madras) will be substantially reduced as a result of the assistance which will be given from Pusa but it is not possible at present to state the exact figure. The Sub-Committee recommends that the amount be settled by the Vice-Chairman in correspondence with the Director, Imperial Institute of Agricultural Research.

The Sub-Committee also approves of the proposed arrangements for the breeding of rust-resistant wheats. The cost of this for the three years is estimated at Rs. 5,760 *plus* the rent of the land which may amount to Rs. 600 over the whole period.

The exact figure for which financial sanction is required cannot be stated at the moment but it will be less than Rs. 1,35,000 for the three year period by the amount which it is possible to save under item X. The Sub-Committee recommends that sanction be given accordingly.

B. C. BURT.

SIMLA,

The 7th September 1934.

APPENDIX LVIII.

NOTE, DATED THE 31ST JULY 1934, ON SUBJECT No. 56, REPORT ON THE INVESTIGATIONS ON ' CEREAL RUSTS ' BY DR. K. C. MEHTA, FOR THE YEAR 1933-34.

At its meeting held in August, 1933, the Advisory Board considered the final report submitted by Dr. Mehta on his investigations on Cereal Rusts during the first period of 3 years of his scheme, ending April, 1933 (*vide* printed proceedings of the Board, August, 1933, pages 524—562). The scheme has since been extended for a further period of two years from that date and Dr. Mehta has now submitted his report (not printed) in respect of the first year of the extended scheme covering the period 1933-34. This report is for the consideration of the Advisory Board.

2. Dr. Mehta has also applied for a further extension of the scheme for 3 years after April, 1935, and it is proposed that this should be considered by a Sub-Committee of the Board. The above Progress Report will also be examined by the same Sub-Committee, whose report will be circulated to the Advisory Board in due course.

APPENDIX LIX.

NOTE, DATED THE 4TH AUGUST 1934, ON SUBJECT No. 57, APPLICATION FROM THE GOVERNMENT OF THE UNITED PROVINCES, FOR A GRANT OF RS. 1,24,000 FOR THE CONTINUANCE OF THE INVESTIGATIONS ON CEREAL RUSTS BY DR. K. C. MEHTA, PROFESSOR OF BOTANY, AGRA COLLEGE, FOR A FURTHER PERIOD OF THREE YEARS FROM APRIL 1935.

At its meeting held in July 1932, the Advisory Board recommended a scheme for the extension of Dr. K. C. Mehta's investigations on cereal rusts, for a period of two years with effect from 1st April 1933, the date on which Dr. Mehta's original scheme terminated. The proposals for the extension were examined in the first instance by a Committee of Mycologists whose recommendations were accepted by the Advisory Board. The report of this Committee (and the papers circulated to it) and the discussions of the Board thereon will be found on pages 14-15 and 123-182 of the printed proceedings of the Board; the extension of the scheme was effective from April 1933. Dr. Mehta's progress report on the work of the year 1933-34 has been submitted to the Board separately. It is only necessary to say here that, as the result of successful research, the scheme has now reached an important stage as promising developments in plant breeding and other practical measures of control are in sight.

2. Reference is now invited to the attached copy of a letter (Annexure I) from the Government of the United Provinces No. 768, dated the 19th June 1934 and the enclosures forwarding an application from Dr. Mehta for the continuance of his investigations for a further period of three years from April 1935 when the present extended period will terminate. The proposal as recommended by the United Provinces Provincial Agricultural Research Committee involves, so far as the Council is concerned, a recurring expenditure of Rs. 1,09,000 and non-recurring expenditure of Rs. 15,000 (or a total of Rs. 1,24,000) spread over three years.

3. With regard to the technical programme of the work proposed to be done, reference is invited to a demi-official letter, dated the 6th July 1934, and enclosure (Annexure II) from Dr. F. J. F. Shaw, Director and Imperial Economic Botanist, Imperial Institute of Agricultural Research, Pusa, offering the co-operation of the Second Imperial Economic Botanist (Dr. Pal) and himself in the breeding of strains of wheat resistant to specific biological forms of rust. Dr. Mehta has discussed matters with Dr. Shaw and Dr. Pal and is in favour of this modification of his scheme.

4. The Vice-Chairman to the Council considers that it would be an advantage if the details of the scheme were first examined by a Sub-Committee of the Advisory Board consisting of the undermentioned gentlemen:—

1. Sir T. Vijayaraghavacharya, K.B.E., Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa.

4. Dr. W. Burns, Director of Agriculture, Bombay.
5. Mr. P. B. Richards, Officiating Director of Agriculture, United Provinces.
6. Khan Bahadur Fateh-ud-Din, Officiating Director of Agriculture, Punjab.
7. Mr. D. R. Sethi, Director of Agriculture, Bihar and Orissa.
8. Mr. J. H. Ritchie, Director of Agriculture, Central Provinces.
9. Mr. W. Jenkins, Chief Agricultural Officer, Sind.
10. Professor J. H. Mitter, Allahabad University.
11. Professor T. Ekambaram, Madras University.
12. Dr. K. C. Mehta, Professor of Botany Agra College.
13. Dr. B. C. Pal, 2nd Imperial Economic Botanist.

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, Secretary *ex-officio*.

The progress report for 1933-34 will be referred to the same Sub-Committee which will meet on an afternoon between the 3rd and 8th September 1934 and its report will be submitted to the Advisory Board in due course.

5. The application is for the consideration of the Advisory Board.

ANNEXURE I.

Copy of a letter No. 768, dated the 19th June 1934, from the Secretary to the Government, United Provinces, to the Secretary, Imperial Council of Agricultural Research.

I am directed to forward herewith an application from Dr. K. C. Mehta, M.Sc., Ph.D., Agra College, Agra, for a further grant of Rs. 1,24,000 (Rs 15,000 non-recurring and Rs. 1,09,000 recurring) spread over three years for the continuance of investigations on 'Cereal Rusts' in India, during 1935-38 (as modified in accordance with resolution No. 5, dated April 27, 1934 of the United Provinces Agricultural Research Committee, copy enclosed), for consideration at the next meeting of the Advisory Board of the Imperial Council of Agricultural Research.

2. I am to say that the United Provinces Government have not examined this proposal and do not desire to be understood to express any opinion on its value.

Copy of Resolution No. 5 passed at the 10th meeting of the United Provinces Agricultural Research Committee held at the Council House, Lucknow, on April 27, 1934, at 9-30 a.m.

Resolution.

Agenda.

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|--|--|
| <p>5. Consideration of application from Dr. K. C. Mehta, M.Sc., Ph.D., Professor of Botany, Agra College, Agra, to the Imperial Council of Agricultural Research for a grant of Rs. 1,31,898 (non-recurring Rs. 21,000 and recurring Rs. 1,10,898) spread over three years for the continuance of investigations on 'cereal rusts' in India, during 1935-38.</p> | <p>5. Resolved that the scheme as amended by the Committee to Rs. 1,24,000 be recommended to the Imperial Council of Agricultural Research, subject to the condition that the Advisory Board may if they consider it desirable reduce rates of pay for staff so as to bring them in line with the other schemes recently sanctioned.</p> |
|--|--|

APPLICATION FROM DR. K. C. MEHTA, M.Sc., Ph.D., PROFESSOR OF BOTANY, AGRA COLLEGE, AGRA, TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, FOR A FURTHER GRANT OF RS. 1,24,000 (RS. 15,000 NON-RECURRING AND RS. 1,09,000 RECURRING) SPREAD OVER THREE YEARS FOR THE CONTINUANCE OF INVESTIGATIONS ON "CEREAL RUSTS" IN INDIA, DURING 1935-38 (AS MODIFIED IN ACCORDANCE WITH RESOLUTION No. 5, DATED APRIL 27, 1934, OF THE UNITED PROVINCES, AGRICULTURAL RESEARCH COMMITTEE.

Copy of letter No. 656, dated 17th March 1934, from Dr. K. C. Mehta, M.Sc., Ph.D., Professor of Botany, Agra College, Agra, to the Secretary, Imperial Council of Agricultural Research, through the Principal, Agra College, Agra.

I have the honour to approach you for a grant of Rs. 1,31,898, Rs. 21,000 non-recurring and Rs. 1,10,898 recurring, spread over three years for the continuance of investigations on "Cereal Rusts" in India, during 1935-38.

A sum of another Rs. 12,000 may be required for a co-ordinated scheme of rust survey in the Punjab, Bombay-Deccan, and Madras, if the departments of Agriculture in those provinces are willing to undertake the work.

The period of the present scheme, which was sanctioned in the year 1933, will expire in March 1935.

I beg to enclose herewith a note stating briefly the results obtained so far, the programme of work and detailed estimates of expenditure under the proposed scheme.

For detailed information on the progress of investigations since 1930, kindly refer to my report for 1932-33 and an article, recently published in the *Indian Journal of Agricultural Science*, Volume III, Part VI, 1933.

I hope that the Imperial Council of Agricultural Research will kindly sanction funds for the continuity of these investigations, which when completed, should be of great value to agriculture in this country.

CONTINUANCE OF INVESTIGATIONS ON "CEREAL RUSTS" IN INDIA FOR A FURTHER PERIOD OF THREE YEARS, 1935—38.

The present scheme of work on cereal rusts under the auspices of the Imperial Council of Agricultural Research, sanctioned in the year 1933, will expire in March 1935. The proposed scheme as outlined below, is intended to provide for a natural expansion of the scope of work on different aspects of the problem under study.

This note has been written in continuation of my last annual report, a summarized account of which has recently been published in the *Indian Journal of Agricultural Science*, Volume III, Part VI, December 1933.

The present position for our knowledge regarding the rusts under reference, may be briefly stated as follows :

1. Annual outbreaks of yellow rusts of wheat and barley on the plains of India are caused by wind-blown uredospores which are disseminated from comparatively high altitudes in the hills, where they oversummer.

2. As far as the plains are concerned, species of *Berberis* and *Thalictrum*, the alternate hosts for black rust of cereals and the brown rust of wheat, respectively seem to play little part in the yearly origin of those rusts.

3. *Berberis vulgaris*, raised from seed collected in England, has been successfully infected by sporidia of black rust of wheat in this country. Wheat and barley were infected by aecidiospores thus produced. The role of indigenous species of *Berberis* in the life-history of black rust is under study at present.

4. Since the last report, germination of the teleutospores of brown rust of wheat has also been obtained and experimental work with indigenous species of *Thalictrum* is in progress.

5. Brown rust of wheat and the black rusts of wheat and barley are in all probability disseminated to the plains from comparatively low altitudes, where on account of a milder winter their uredospores occurring at the time of sowing cause outbreaks on the new crop rather early in the season (November-December). Both these rusts have recently been found to oversummer at altitudes of 3,500—4,000 feet under natural irrigation in the Kumaon hills.

6. Study of rust dissemination with the help of slides exposed in aeroscopes, practically all over the country and those sent up on kites, has yielded valuable information with regard to the directions along which dissemination takes place.

7. So far 108 samples of black rust and 58 of brown (including the samples recorded in the last report) have been studied in detail. These samples have yielded only four physiologic forms of black rust, i.e., XV, XL, XLII and LXXV and two forms of brown, i.e., X and a new form, which has been allotted the International form number LVIII. List of samples studied since last report, is attached herewith.

8. There is a strong evidence, both circumstantial and scientific in support of the writer's contention that the number of physiologic forms of the rusts under study should not be large in this country.

9. The complete absence of the alternate hosts for brown and black rusts on the plains, which occupy nearly 95 per cent. of the area under wheat and barley, is the most hopeful feature of the problem as far as measures of control are concerned.

10. Propagation of rusts by uredospores from season to season, which takes place in some other countries, is impossible on the plains of India in general on account of the intense heat of summer. It is almost impossible for the uredospores to survive after the harvest on the plains as a whole.

11. On the basis of data obtained so far, the writer is fully convinced of the fact that the problem under study is unique, as far as this country is concerned and the possibility of controlling rusts by the methods already suggested, is infinitely greater than elsewhere.

In the light of the facts stated above, it is essential to continue the pursuit in order to understand the problem as a whole before measures of control can be adopted.

The programme of work during 1935—38 shall be as follows :

- (1) Study of the physiologic forms of all the three rusts of wheat. We should be able to study 250—300 samples each year with additional greenhouse accommodation and staff, as shown in the estimates of expenditure, attached herewith. At present there is provision only for the study of 150 samples per year.
- (2) Intensive study of the suspected role of indigenous species of *Berberis* and *Thalictrum* in the life-histories of black and brown rusts, respectively. In addition to the study of aecidial material in nature inoculation will be made, as at present, with germinating teleutospores of both the rusts on their respective alternate hosts. This work has been in progress for some time and as stated above, we have recently obtained germination of the teleutospores of brown rust as well.
- (3) Testing the pathogenicity of pure cultures of all the six physiologic forms (four of black and two of brown, met with so far, and those that may be discovered later) on popular Indian wheats from each province. Fifty-two Indian wheats have already been tested this year.
- (4) Location of the foci of infection in the hilly areas in different parts of the country and the study of incidence of rusts on the plains in their neighbourhood. Very useful information on this important aspect of the problem has been obtained during the last three years and it is absolutely necessary that this study be continued till we have finally located all the foci.
- (5) Study of rust dissemination with the help of aeroscope slides will be continued. Wind trajectories for some of the stations have already been prepared and this work will considerably help investigations under the last item.

- (7) Comparative study of the investigations on cereal rusts in United States of America and Canada and Germany and selection of promising varieties of wheat with special reference to the physiologic forms occurring in this country.

SURVEY OF RUSTS.

- (8) Side by side with the work outlined, above, it is very desirable that a place to place survey of oversummering of rusts and their incidence on crops be carried out in the Punjab, Bombay-Deccan and Madras. Information obtained from such a survey should be very useful for the adoption of measures of control at a later date. I am of the opinion that work of that type should be placed under the control of the provincial departments of Agriculture and the personal supervision of the Mycologists in those provinces.

Two of my assistants who have been doing this work from time to time, should be available for casual guidance on the spot to the staff that may be employed for survey in the provinces. The co-ordination necessary for such a study, could be easily obtained by exchange of periodic reports between the provincial Mycologists and myself. At the end of each year a joint report may be submitted to the Imperial Council of Agricultural Research on the survey done during that period.

The cost of survey in the areas referred to above, may come to Rs. 12,000 or so for a period of three years.

I hope, that funds would be sanctioned for the continuity of investigations on this problem, which is of all-India importance and when fully understood should lead to results of great value to agriculture in this country.

A list of samples studied since the last report, to show the physiologic forms met with.

BLACK RUST.

Serial No.	Province.	Locality.	Original host.	Forms picked up.
	<i>Pending samples of 1931-32</i>			
1	Punjab	Narkunda ..	Local	XV.
2	Do.	Mattiana ..	Bromus patulus ..	XV and XLII.
3	United Provinces ..	Allahabad ..	Local	XV.
4	Bihar	Pusa	Pusa 101	XV.
5	Madras	Bellary	Local	XL.
6	Do.	Ketti	Do.	XV.

Serial No.	Province.	Locality.	Original host.	Forms picked up.
<i>1932-33 samples.</i>				
1	Punjab	Simla	Local	XV, XLII.
2	Do.	Do.	Aecidium petiole ..	XLII.*
3	Do.	Do.	Aecidium nectar mixed.	New.*
4	Do.	Do.	Brachypodium ..	XL, XLII.
5	Do.	Koti	Local	XV.
6	Do.	Narkunda ..	Do.	XV, LXXV.
7	Do.	Mattiana ..	Do.	XL, LXXV.
8	Do.	Karnal	Pusa 805	XV and XLII.
9	Do.	Upper Kangra Valley.	Local	XV.
10	Do.	Lahore	Do.	XV.
11	Do.	Pathankote ..	Do.	XV.
12	Baluchistan ..	Quetta	Do.	XV.
13	Sind	Sakrand	Manitoba Pusa 12	XV.
14	United Provinces ..	Agra	Hope	XV.
15	Do.	Do.	Local	XV.
16	Do.	Chakrata ..	Do.	XV, XLII.
17	Do.	Nautanwa ..	Do.	XL.
18	Do.	Lower Kumaun ..	Do.	XLII, XL.
19	Do.	Bareilly	Do.	XV.
20	Do.	Pilibhit	Do.	XV.
21	United Provinces ..	Bara Banki ..	Local	XLII, XL.*
22	Do.	Nepalgarh ..	Do.	XL.
23	Do.	Someswar	Do.	XLII.
24	Do.	Lucknow	Do.	XLII.
25	Do.	Chandausi ..	Do.	XLII.
26	Bihar	Pusa	Pusa 4	XLII, LXXV.
27	Do.	Do.	Pusa 12	LXXV.
28	Do.	Sabour	Pusa 111	XL.
29	Do.	Jogbani	Local	XV, XLII.

* Study not yet complete.

Serial No.	Province.	Locality.	Original host.	Forms picked up.
30	Bengal	Malda	Pusa 12	XL, XLII.
31	Central Provinces ..	Jubbulpore ..	A. O. 90	XV.
32	Do.	Khandwa	Local	XV.
33	Central India	Dhamnod	Do.	XL.
34	Rajputana	Ajmer	Do.	XL, XLII.
35	Bombay-Deccan ..	Sarakhdi	Pusa 4	XLII.
36	Do.	Niphad	Bansi	XLII.
37	Do.	Do.	Pusa 4	XL, XLII.
38	Do.	Do.	St. no. 809 ..	XLII.
39	Do.	Do.	Pusa 111	XL, XLII.
40	Do.	Do.	Khapli	XV, XLII.
41	Do.	Junagad	Katha red	XV.
42	Do.	Dangs	Local	XV.
43	Do.	Babkhara	Bansi	XL, XLII.
44	Do.	Babula	Mundi	XL, LXXV.
45	Do.	Shingerwari ..	Bodke	XV, XLII.
46	Do.	Baroda	Pusa 4	XL, XLII.
47	Do.	Baroda State ..	Wagia	XV, XLII.
48	Do.	Dharwar	Local red	XL.
49	Do.	Do.	Var. 808	XL.
50	Do.	Ghats	Local	LXXV.
51	Do.	Poona	Charoli	XV, XLII.
52	Do.	Do.	Potia	XV.
53	Do.	Do.	Pusa 4	XV.
54	Do.	Do.	Wagia	XV.
55	Do.	Do.	Gorya	XV.
56	Do.	Do.	Saraba	XV.
57	Do.	Do.	Phadni	XV.
58	Do.	Do.	Pissi	XV.
59	Do.	Do.	Chandausi	XV.

Serial No.	Province.	Locality.	Original host.	Forms picked up.
60	Bombay-Deccan ..	Poona ..	St. no. 162 ..	XV.
61	Do. ..	Do. ..	Popana ..	XV.
62	Do. ..	Do. ..	Joneira ..	XV.
63	Do. ..	Do. ..	Sotparner ..	XV.
64	Do. ..	Do. ..	Sudhe ..	XV.
65	Do. ..	Do. ..	Daudkhanired ..	XV.*
66	Do. ..	Do. ..	Australian ..	XV.
67	Hyderabad-Deccan	Himayatsagar ..	Pusa 80-5 ..	XL, XLII.
68	Do. ..	Do. ..	C. 13 ..	XLII.*
69	Do. ..	Islampur ..	Hard red ..	XV.
70	Do. ..	Parbhani ..	Local ..	XV.
71	Mysore State ..	Maridehatti (Chitaldroog).	Do. ..	XL, XLII.
72	Madras ..	Coimbatore ..	Pusa 4 ..	XV.
73	Do. ..	Do. ..	Pusa 52 ..	XL.

* Study not yet complete.

A list of samples studied since the last report to show the physiologic forms met with.

BROWN RUST.

Serial No.	Province.	Locality.	Original host.	Forms picked up.
	<i>Pending samples of 1931-32.</i>			
1	Punjab ..	Narkunda ..	Local ..	New.
2	United Provinces ..	Almora ..	Do. ..	New, X.
3	Do. ..	Allahabad ..	Do. ..	New, X.
4	Bihar ..	Pusa ..	Do. ..	New.
	<i>1932-33 samples.</i>			
1	Punjab ..	Simla ..	Local ..	New.
2	Do. ..	Kalka ..	Do. ..	New.

Serial No.	Province.	Locality.	Original host.	Forms picked up.
3	Punjab ..	Karnal ..	Local ..	X.
4	Do. ..	Do. ..	Pusa 111 ..	X.
5	Do. ..	Do. ..	Pusa 4 ..	X.
6	Do. ..	Gurdaspur ..	Local ..	X.
7	Do. ..	Delhi ..	Do. ..	New, X.
8	Do. ..	Ambala ..	Do. ..	New.
9	Do. ..	Rawalpindi ..	Do. ..	X.
10	Do. ..	Lyallpur ..	Durum ..	X.
11	Do. ..	Do. ..	Pjb. 17b ..	New, X.
12	Do. ..	Do. ..	Reliance ..	X.
13	Do. ..	Mattiana ..	Local ..	New.
14	Do. ..	Bharakao ..	Do. ..	X.
15	Do. ..	Jammu ..	Do. ..	New, X.
16	United Provinces ..	Bara Banki ..	Morvi ..	X.
17	Do. ..	Do. ..	Local ..	New, X.
18	Do. ..	Bageswar ..	Do. ..	New, X.
19	Do. ..	Someswar ..	Do. ..	New.
20	Do. ..	Almora ..	Do. ..	New, X.
21	Do. ..	Jeolikote ..	Do. ..	New.
22	Do. ..	Kathgodam ..	Do. ..	New, X.
23	Do. ..	Lucknow ..	Do. ..	New, X.
24	Do. ..	Cawnpore ..	Pusa 4 ..	X.
25	Do. ..	Do. ..	Pusa 12 ..	New.
26	Do. ..	Chandausi ..	Local ..	New, X.
27	Do. ..	Agra ..	Pusa 12 ..	X.
28	Do. ..	Do. ..	C. 13 ..	New and X.
29	Do. ..	Bareilly ..	Pusa 112 ..	X.
30	Do. ..	Allahabad ..	Local ..	X.
31	Do. ..	Gonda ..	Do. ..	New, X.
32	Do. ..	Gorakhpur ..	Do. ..	New, X.

Serial No.	Province.	Locality.	Original host.	Forms picked up.
33	United Provinces ..	Benares	Pusa 12	X.
34	Do. ..	Nautanwa	Local	New, X.
35	Do. ..	Nepalganj	Do.	X.*
36	Nepal	Pipari	Do.	X.
37	Bihar	Jogbani	Do.	New.
38	Do.	Sabour	Pusa 111	X.
39	Hyderabad-Deccan	Himayatsagar ..	A. O. 28	X.
40	Madras	Anakorai	Local	X.
41	Do.	Kodaikanal	Do.	X.
42	Do.	Coimbatore	Pusa 80—5	X.
43	Do.	Do.	Local	X.

* Study not yet complete.

The "New" Form has been allotted the International Form no. LVIII.

Estimate of expenditure over the continuance of investigations on cereal rusts for 3 years 1935—38.

Particulars.	At	1935-6.	1936-7.	1937-8.	Remarks.
	Rs.	Rs.	Rs.	Rs.	
<i>I.—Establishment.</i>					
(1) For the laboratory at Simla—					
(i) One assistant	200—20—240	2,400	2,640	2,880	
(ii) One junior assistant ..	125—10—150	1,500	1,620	1,800	
(2) For work on physiologic forms, location of foci of infection, study of aëroscope slides and testing popular varieties of Indian wheats—					
(iii) One senior assistant ..	250—25—300	3,000	3,300	3,600	
(iv) One assistant	175—10—200	2,100	2,220	2,400	
(v) One assistant	175—10—200	2,100	2,220	2,400	
(vi) One assistant	175—10—200	2,100	2,220	2,400	

Particulars.	At	1935-6.	1936-7.	1937-8.	Remarks.
	Rs.	Rs.	Rs.	Rs.	
(vii) One junior assistant ..	80—10—100	960	1,080	1,200	
(viii) One junior assistant ..	80—10—100	960	1,080	1,200	
(3) For meteorological data and wind trajectories—					
One assistant for 6 months each year.	75 per mensem	450	450	450	
(4) Typist and clerk, an L. Ag. who is also working as a part-time assistant.	80—10—100	960	1,080	1,200	
(5) Menial staff—					
(i) One bearer for laboratory..	16 per mensem	192	192	192	
(ii) One bearer for the laboratory at Simla.	18 „	216	216	216	
(iii) One bearer for the laboratory at Simla.	16 „	192	192	192	
(iv and v) Two bearers for the laboratory at Agra.	16 „	384	384	384	
(vi and vii) Two bearers for 6 months only.	16 „	192	192	192	
(viii) One bearer for work at Observatory for 6 months only.	16 „	96	96	96	
(ix) One chaulkidar at Agra ..	12 „	144	144	144	
(x) One part-time sweeper for the laboratory at Simla.	5 „	60	60	60	
II.—Equipment.					
Construction of greenhouses, microscopes, thermo-hydrographs, typewriter, glass cases, screens, etc.	....	9,000	..	..
	Rs.				
(i) One cool greenhouse at Simla.	1,200				
(ii) Extension of 3 small greenhouses for live cultures of rusts.	1,000				
(iii) One large greenhouse at Simla for brown rust.	1,600				

Particulars.	At	1935-6.	1936-7.	1937-8.	Remarks.
(iv) One large green-house at Agra.	1,800				
(v) Microscopes (2) ..	450				
(vi) Thermohygro-graphs (3).	650				
(vii) Miscellaneous equipment.	2,300				
III.—Maintenance and contingent expenses.					
Including rent of the laboratory at Simla.	3,600 per year	3,600	3,600	3,600	
IV.—Travelling allowances.					
For the officer incharge* and tho establishment.	5,000 per year	5,000	5,000	5,000	
V.—To house rent at Simla.					
To migratory assistants ..	800 per year	800	800	800	
VI.—To Agra College.					
For teaching arrangements ..	6,000 per year	6,000	6,000	6,000	
VII.—To the officer incharge in lieu of rent-free house.					
For rent-free house at Agra College	1,200 per year	1,200	1,200	1,200	
VIII.—To a visit to U. S. A., Canada and Europe.					
For comparative study ..	6,000 ..	6,000	..	..
IX.—Miscellaneous.					
For sundry expenses ..	....	300	300	202	
Total ..	....	49,906	36,286	37,808	

* The total amount of travelling allowances for the officer incharge not to exceed Rs. 2,500.

		Rs.
Total expenditure for	1935-6	.. 49,906
Do.	1936-7	.. 36,286
Do.	1937-8	.. 37,808

GRAND TOTAL .. 1,24,000

X.—For place to place survey for overwintering of rusts and their incidence on crops in the Punjab, Bombay—Deccan and Madras. Work to be done under the control of the departments of Agriculture in those provinces if they are willing to participate.

Approximate cost including Rs. salaries and travelling allowances for 3 years, i.e.,
1935-8 .. 12,000

ANNEXURE II.

Copy of a demi-official letter No. 170 C., dated the 6th July 1934, from Dr. F. J. F. Shaw, Director, Imperial Institute of Agricultural Research, Pusa, to the Agricultural Expert, Imperial Council of Agricultural Research.

With reference to our visit to the rust research laboratory and the results which Mehta showed us there I consider that the Mycological side of this work has reached a stage at which it is possible to take up the breeding of rust-resistant wheat for India. I therefore sent for Dr. Pal who is in charge of the wheat breeding work at Pusa, and he and Mehta have, in consultation with me, drawn up the attached programme of investigation. We consider that crossing work and the growing of the F_1 generation should be done at the rust research laboratory in Simla and that the growing of the F_2 population should be done both in the hills and in the plains at Pusa.

2. This additional work at the rust research laboratory will require the strengthening of the staff by the addition of an Assistant on Rs. 150 per month. It will not be difficult to obtain a suitably trained man from among the post-graduate students who have completed their training at Pusa.

3. In connection with the suggestion, which has I believe been made that a man should be sent abroad for training, I would point out that Dr. Pal who has only just joined us, has had training at Cambridge where he has been working under Biffen and Engledow for several years.

4. In addition to the strengthening of the staff the area of the rust research laboratory will have to be increased by renting the field which is just below the laboratory. This field however, will not be required until the work has been in progress for one year. I think that it should be possible to initiate this work by sowing the necessary autumn wheat in the coming October this year. I do not know what it will cost to rent this land but the addition to the total cost on account of salary will be about Rs. 2,000.

SCHEME FOR BREEDING RUST-RESISTANT WHEAT FOR INDIA.

(Being a Note on the Plant Breeding Aspect of the Investigation on "Cereal Rusts".)

The investigation on "Cereal Rusts" has reached a stage when the information obtained may be applied to the problem of breeding rust-resistant wheats for India.

The encouraging fact has been established that there are probably not more than 4 physiologic races of black rust, 2 of brown rust and 3 of yellow rust, and that the number is not likely to be increased by hybridization as the infection is carried over from year to year by the uredospores in localities where the climate is suitable, and alternate hosts on which the sexual phases of the life-cycle are completed appear to be absent in the case of Indian rusts.

Taking the rusts in turn, the position at present and the work to be immediately done is as follows:—

Yellow rust.—In this case, 6 out of 10 differentials (all foreign varieties of vulgare type) have been found to be immune or highly resistant. The problem here, therefore, appears to be relatively simple. Seed

of the immune types will be procured this year, and after observation the best of these will be crossed with suitable indigenous types.

Brown rust.—Two exotic varieties of *vulgare* wheat, Democrat and Mediterranean are resistant to the forms of brown rust occurring in India. These will be crossed with indigenous varieties. The sample of Democrat in the Rust Research Laboratory is attractive in appearance.

Black rust.—None of the wheat varieties so far tested is resistant to the 4 physiologic forms of this rust occurring in India. The *dicoccum* variety, Khapli, however, is resistant to three of them (forms XV, XL & LXXV) while another *dicoccum* variety, Vernal, and two *vulgare* varieties, Reliance and Kota, are all resistant to two of them (forms XLII and LXXV).

It should therefore be possible to combine resistance to all four in one variety by crossing Khapli with either Vernal Reliance or Kota. As Khapli and Vernal are *dicoccum* wheats and Reliance and Kota are unlikely to be suitable for cultivation under Indian conditions, it will be further necessary, when a segregate resistant to all 4 forms of rust is obtained to cross it with the best indigenous *vulgare* varieties such as Pusa 52, Pusa 111, Pusa 114, etc. The scheme of hybridization will be as follows :—

<i>Khapli</i> × <i>Vernal</i> .	<i>Khapli</i> × <i>Reliance</i> .	<i>Khapli</i> × <i>Kota</i> .
Resistant × Suitable segregate. <i>Vulgare</i> variety.	Resistant × Suitable segregate. <i>Vulgare</i> variety.	Resistant × Suitable segregate. <i>Vulgare</i> variety.

It will be advisable to attempt all three crosses as until a cross is actually made, it is impossible, to foresee the complications that may arise due to linkage, etc. In every case, one of the crosses is between varieties of the 28-Chromosome group and those of the 42-Chromosome group. The segregation in such crosses is usually extremely complex and a cytological study at this stage may help in a fuller understanding of the cause of this complexity and its significance in breeding.

General Problem.—As what is required is a wheat resistant not merely to one or two but to all the three rusts, great care will need to be exercised in the choice of parents for crossing. The breeding of a variety resistant to, say, black-rust, will not solve the wheat rust problem. It is unlikely that such a variety would be at the same time resistant to forms of both yellow and brown rust and further hybridization may be necessary. But any varieties which combine such resistance in a large measure, should be utilised to the fullest extent. Thus Khapli which is resistant 3 out of the 4 forms of black rust in India has been found to be also resistant to yellow rust ; it is thus an eminently suitable variety for breeding.

It will be noticed that the varieties so far tested and found resistant are almost all exotics and unlikely to succeed under Indian conditions. The search for resistant Indian varieties should be continued. Varieties such as Pusa 80-5 and Pusa 114 which have not so far been tested should be included in these tests.

The problem of the control of rust can be tackled in two ways. Resistant varieties may be bred to replace those cultivated in the comparatively small wheat area in the hills. As it has been shown to be highly probable

that in India the rusts do not oversummer in the plains, and the crop is freshly infected each year by inoculum blown down from the hills, the growing of only resistant varieties on the hills would soon free the crop of the plains from the rust diseases. The second way is to neglect the comparatively small area in the hills and breed for the plains and thus solve the rust problem directly. As varieties for the hills must have special qualities such as frost-resistance it would perhaps not be any more difficult to breed for the plains; this may be the more desirable course as the former if it is to be successful demands legislation to compel the cultivation of only resistant varieties in the hills and this may prove to be a difficult matter. Both methods will be employed.

The immediate steps to be taken are :—

- (i) To make the Khapli and other crosses.
- (ii) To continue the testing of indigenous varieties for resistance to physiologic strains of the three rusts.
- (iii) To take observations on the progenies derived from the crosses and to select and fix segregates combining resistance to rust with high agricultural qualities.

The work can be carried out with the facilities already given for rust research work, in collaboration with the Botanical Section at Pusa but one more assistant on Rs. 150 per mensem will be necessary to supervise the sowings, make the crosses and take observations at Simla. Crossing will probably be more easily done at Simla and the F_1 's may also be grown here. The F_2 's, however, would be grown both at Pusa and Simla. For it will then be necessary to select for agronomic qualities as well as rust resistance and this will best be carried out under direct supervision of a plant breeder. It will also be necessary to rent a field adjacent to the laboratory in order to provide space for cultures. This need not be done until work has been in progress for a year.

APPENDIX LX.

NOTE, DATED THE 23RD JULY 1934, ON SUBJECT No. 36 (i), (ii) AND (iii) :
 (i) ANNUAL REPORT ON THE WORK OF THE VETERINARY INVESTIGATION OFFICER, MADRAS, FOR 1933-34.* (ii) ANNUAL REPORT ON THE WORK OF THE VETERINARY INVESTIGATION OFFICER, BIHAR AND ORISSA, FOR 1932-33 AND 1933-34.* (iii) ANNUAL REPORT ON THE WORK OF THE VETERINARY INVESTIGATION OFFICER, HYDERABAD, FOR 1932-33 AND 1933-34.*

On the recommendation of the Advisory Board in January 1931 the Governing Body of the Council sanctioned in May 1931 a co-ordinated scheme for investigation in animal diseases in all the provinces and the Hyderabad State. Veterinary Investigation Officers were appointed in the Provinces in two batches, *i.e.*, in some provinces in 1932-33 and in others in 1933-34. In the first year officers were appointed in Bombay, Bengal, Punjab, Bihar and Orissa, Central Provinces and Hyderabad and in the second year in Madras, United Provinces and Assam.

2. The Annual Report of the Bombay Veterinary Investigation Officer for 1932-33 was submitted to the Advisory Board at its meeting held in August 1933. The Annual Reports of the Veterinary Investigation Officers for Bihar and Orissa and Hyderabad for 1932-33 and 1933-34 and for Madras for 1933-34, are now submitted to the Advisory Board for its consideration.

3. These reports will be considered by an *ad hoc* committee at the time of the forthcoming meeting of the Advisory Board and its report will be circulated to the members of the Board in due course.

4. All the other provinces have been reminded for the submission of the annual reports and they will be placed before the Board as soon as they are received.

SUPPLEMENTARY NOTE, DATED THE 21ST AUGUST 1934, ON SUBJECT No. 36,
 (IV) ANNUAL REPORT ON THE WORK OF THE VETERINARY INVESTIGATION OFFICER, PUNJAB, FOR 1932-33 AND 1933-34.* (V) ANNUAL REPORT ON THE WORK OF THE VETERINARY INVESTIGATION OFFICER, BOMBAY PRESIDENCY, FOR 1933-34.* (VI) ANNUAL REPORT ON THE WORK OF THE VETERINARY INVESTIGATION OFFICER, CENTRAL PROVINCES, FOR 1932-33 AND 1933-34.*

In continuation of the note, dated the 23rd July 1934 (on the subject No. 36), already circulated to the members of the Advisory Board, the Reports mentioned above are submitted to the Advisory Board for consideration. They will first be considered by the *ad hoc* Committee appointed to consider similar Reports at the time of the forthcoming meeting of the Advisory Board and its report will be circulated to the members of the Advisory Board in due course.

APPENDIX LXI.

NOTE, DATED THE 21ST AUGUST 1934, ON SUBJECT No. 66, 1. ANNUAL REPORT OF THE WORK OF THE VETERINARY INVESTIGATION OFFICER, BENGAL, FOR 1932-33 AND 1933-34.* 2. ANNUAL REPORT ON THE WORK OF THE VETERINARY INVESTIGATION OFFICER, ASSAM, FOR 1933-34.* 3. ANNUAL REPORT ON THE WORK OF THE VETERINARY INVESTIGATION OFFICER, UNITED PROVINCES, FOR 1933-34.*

Attention is invited to the note dated the 23rd July 1934 (on the subject No. 36) already circulated to the members of the Advisory Board in connection with the Progress Reports on Veterinary Research Schemes sanctioned by the Imperial Council of Agricultural Research.

The Reports mentioned above have since been received and are now submitted to the Advisory Board for consideration. These Reports will first be considered by the *ad hoc* Committee appointed to consider similar Reports (on subject No. 36) at the time of the forthcoming meeting of the Board. Its report will be circulated to the members of the Advisory Board in due course.

*Not printed.

APPENDIX LXII.

REPORT OF THE COMMITTEE APPOINTED TO CONSIDER POTATO RESEARCH SCHEMES.

Present :

Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E., *Chairman.*

Dr. S. P. Agharkar.

Dr. W. Burns.

Mr. B. C. Burt.

Mr. M. Carbery.

Rai Bahadur J. N. Chakravarti.

Khan Bahadur Maulvi Fateh-uddin.

Dr. B. P. Pal.

Prof. P. K. Parija.

Mr. S. V. Ramamurty.

Mr. P. B. Richards.

Mr. J. H. Ritchie.

Mr. T. S. Sabnis.

Mr. D. R. Sethi.

Dr. F. J. F. Shaw.

1. *Annual report on the Madras potato research scheme for the year 1933-34.* (Subject No. 54, Appendix LXIII).—This is in the nature of a preliminary report. The whole policy in regard to potato-breeding was revised as a result of the discussion which took place at the last meeting of the sub-committee and the Advisory Board. This station will receive new material from Cambridge early next year.

Potato-breeding scheme for Northern India. (Subject No. 55, Appendices LXIV and LXIV-A).—The draft scheme which had been prepared in compliance with the recommendation contained in the report of the last meeting of the potato sub-committee, as adopted by the Advisory Board, was considered in detail. The sub-committee agreed that the best method of dealing with the potato problem in Northern India was to accept the suggestion that this work should be undertaken by the Second Imperial Economic Botanist. For this purpose hill station will be required which should be provided from the Council's grant. The plains station would be at Pusa for the present (and subsequently at Delhi) where most of the equipment required is already available.

2. The sub-committee considers that before the site for the hill station is settled, preliminary experiments should be made during the summer of 1935 at a number of places in the hills (with a limited number of varieties of potatoes to be specified by the Imperial Economic Botanist) to ascertain at what station potatoes will fruit and produce viable seed with the greatest certainty. The Directors of Agriculture concerned have offered facilities at the following places :—Chaubattia and Ramgarh (United Provinces), the Kulu Valley, Murree hills and possibly Kotgarh in the Punjab and Shillong (at places of suitable altitude and a grant not exceeding

Rs. 500 for each centre should be provided to meet any necessary charges—total Rs 3,000. Experiments will also be carried out at Simla in the land adjoining the Rust Research Laboratory which can be obtained on rent for the purpose.

3. The experimental programme as outlined in the draft scheme was approved generally.

4. It is recommended that sanction be given to the following portions of the potato-breeding scheme :—

(1) Non-recurring grant for work at Pusa (and subsequently Delhi)—Rs. 3,050.

(2) Recurring grant for work at a hill station of Rs. 7,500 per annum for a period of five years to cover the items shown in the draft scheme. The full provision will not be required in the first year but details can be settled with the Secretariat of the Council.

5. The permanent equipment for the hill station will depend to a considerable extent on the site chosen as much will depend whether land and buildings can be rented or obtained on loan. It is understood that at Chaubattia, for example, special facilities could be given at the Fruit Research Station if this altitude and locality proves suitable.

6. In view of the fact that very valuable material from Cambridge is expected at once, the sub-committee recommends that special priority be given to this scheme.

B. C. BURT.

SIMLA,

The 7th September 1934.

APPENDIX LXIII.

NOTE, DATED THE 18TH AUGUST 1934, ON SUBJECT NO. 54, ANNUAL REPORT OF THE MADRAS POTATO RESEARCH SCHEME FOR THE YEAR 1933-34.

The attached report (not printed) on the Madras Potato Research Scheme for the year 1933-34, which has been received from the Government of Madras, is submitted for the consideration of the Advisory Board. A copy of the scheme will be found at pages 228—233 of the proceedings of the meeting of the Advisory Board held in July 1932.

2. It is proposed that the report should first be examined by the Potato Sub-Committee of the Board consisting of:—

The Vice-Chairman, Imperial Council of Agricultural Research,
Chairman *ex-officio*.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Madras.

The Director of Agriculture, Bombay.

The Director of Agriculture, Bengal.

The Director of Agriculture, United Provinces.

The Director of Agriculture, Punjab.

The Director of Agriculture, Bihar and Orissa.

The Director of Agriculture, Central Provinces.

The Director of Agriculture, Assam.

The Director, Imperial Institute of Agricultural Research, Pusa.

Professor P. K. Parija, Ravenshaw College, Cuttack.

Dr. B. C. Pal, 2nd Imperial Economic Botanist, Imperial Institute of Agricultural Research, Pusa.

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, Secretary *ex-officio*.

This Committee will meet on an afternoon between the 3rd and 8th September, 1934, and its report will be submitted to the Advisory Board in due course.

APPENDIX LXIV.

NOTE, DATED THE 11TH AUGUST, 1934, ON SUBJECT No. 55, POTATO BREEDING SCHEME FOR NORTHERN INDIA.

At its meeting held in February 1934, the Advisory Board considered schemes for potato research submitted by the Governments of Bengal, United Provinces, Punjab, Bihar and Orissa, Central Provinces and Assam. The schemes were first examined by a Sub-Committee of the Board a copy of whose report is attached (Annexure I). This report was adopted by the Board, relevant extracts from whose proceedings are also enclosed (Annexure II).

2. The Committee recommended that a preliminary scheme should be worked out. A note by the Agricultural Expert to the Council (Annexure III) containing his suggestions on the subject, is attached. The note also explains the action already taken to obtain phytophthora-resistant and other new material through Dr. Hudson and from Russia.

3. The subject will first be examined by a Sub-Committee consisting of :—

The Vice-Chairman, Imperial Council of Agricultural Research,
Chairman, ex-officio.

The Agricultural Expert, Imperial Council of Agricultural Research.

The Director of Agriculture, Madras.

The Director of Agriculture, Bombay.

The Director of Agriculture, Bengal.

The Director of Agriculture, United Provinces.

The Director of Agriculture, Punjab.

The Director of Agriculture, Bihar and Orissa.

The Director of Agriculture, Central Provinces.

The Director of Agriculture, Assam.

The Director, Imperial Institute of Agricultural Research, Pusa.

Professor P. K. Parija, Ravenshaw College, Cuttack.

Dr. B. C. Pal, 2nd Imperial Economic Botanist, Imperial Institute of Agricultural Research, Pusa.

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, Secretary, *ex-officio.*

The Sub-Committee will meet on an afternoon between the 3rd and 8th September 1934, and its report will be submitted to the Advisory Board in due course.

ANNEXURE I.

Report of Committee on potato Research Schemes, February 22nd, 1934.

PRESENT :

Diwan Bahadur Sir T. Vijayaraghavacharya, *Chairman.*

Professor S. P. Agharkar,

Mr. R. G. Allan.

Dr. W. Burns.

Mr. B. C. Burt,

Dr. P. S. Hudson,

Mr. V. N. Likhite,

Mr. K. McLean,

Dr. W. McRae,

Dr. S. K. Mitra,

Professor P. Parija,

Mr. J. H. Ritchie,

Mr. H. R. Stewart,

Rao Bahadur B. Viswanath.

The following schemes for potato research were before the Committee :—

- A.—Application from the Government of Bengal for a grant of Rs. 48,950 spread over five years.
- B.—Application from the Government of the United Provinces for a grant of Rs. 41,790 spread over five years.
- C.—Application from the Government of Punjab for a grant of Rs. 37,760 spread over five years.
- D.—Application from the Government of Bihar and Orissa for a grant of Rs. 28,696 spread over three years.
- E.—Application from the Government of the Central Provinces for a grant of Rs. 15,246 spread over three years.
- F.—Application from the Government of Assam for a grant of Rs. 56,948 spread over five years.

2. Members of the Committee had received copies of translations of some Russian literature on potato-breeding lent by the Imperial Bureau of Plant Genetics (Cambridge) and Dr. Hudson, Deputy Director of the Bureau summarised the present position. Until recently potato breeding work in Europe had been carried out on very limited material and progress had been carried out on very limited material and progress had in consequence been limited of late years. He considered that if breeding work in India were confined to material available in India or obtainable from Europe much progress would be made. In 1925, the Russian Soviet Government sent a scientific expedition to South and Central America

(Mexico, Guatamala, Columbia, Peru, Bolivia, Chili and the country down to the Argentine) which brought back 1,000 specimens and made important discoveries. In South America there was found a number of cultivated varieties quite different from those of Europe. There were also wild species of importance collected from the hill sides of the Andes (even up to 15,000 feet) and a wealth of new forms was brought back including 14 species of cultivated potatoes and several dozen species of wild potatoes. Some of these species possess valuable properties, e.g. Frost resistance and resistance to blight (*Phytophthora*) and suitability to a short day. The chromosome numbers were 24, 36, 48, 60 and 72 whereas European cultivated potatoes have a chromosome number of 48. A number of hybrids were obtained by Russian workers which yielded fertile seed.

He considered that the first step would be to send an expedition to South and Central America before proceeding further. He did not think the requisite material could be obtained from Russia.

3. The Committee, after discussion are of opinion :—

- (i) that most of the important problems of potato growing in Northern India could be studied at a single central research station with provincial testing stations and that the question of the most suitable locality should be examined in detail and a preliminary scheme worked out.
- (ii) The possibility of an expedition to South and Central America preferably in co-operation with other parts of the Empire should be investigated and, the Committee recommended that the High Commissioner for India should be asked to bring the matter before the Executive Council of the Imperial Agricultural Bureaux.
- (iii) Dr. Hudson should be requested to ascertain what suitable phytophthora-resistant and other new material could be obtained from the Laboratory of the late Professor Baur and from the United States of America, Department of Agriculture (Plant-Introduction Bureau).
- (iv) An attempt should be made to get some *Phytophthora*-resistant types and hybrids from Russia in exchange for seed, etc., supplied from India.

ANNEXURE II.

Extracts from the proceedings of the Advisory Board, February 1934.

Mr. Burt in introducing the report suggested that, as one Committee had examined all the schemes together, it would be as well for the Board to consider them at the same time. He then explained the recommendations made by the Committee in regard to these schemes and formally moved the adoption of the Committee's report. Dr. Hudson seconded the motion and particularly referred to the desirability of establishing a Central Research Institute for Potato in India and also commended the recommendation of the Committee in regard to the sending of an expedition to South

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and Central America. In this connection Dr. Hudson referred to the scientific expedition sent by the Russian Soviet Government in 1925 to South and Central America which brought back a large number of specimens of new species of cultivated potato as well as wild potatoes and commended the suggestion that India might also send an expedition there. Dr. Nehru said that as far as he knew the Russian Institute would be very willing to supply the necessary information to any Institute in India in regard to this matter. Dr. Hudson said that while the Russian institutes would be willing to supply sets and seeds to the older type of potato, they would not be likely to supply any of the new varieties which they had found at any rate at present. Dr. Nehru was however of the opinion that Soviet Russia would be quite willing to exchange Indian exhibits for Russian varieties. The Report was then adopted.

Dr. Hudson explained that, even so, one could not possibly expect to get all the new material which the expedition had brought back and that it was very likely that some of the forms of most value to India but not so useful to Russia were not now maintained in Russia even if they had been collected.

ANNEXURE III.

Note by Agricultural Expert, I. C. A. R.

At the last meeting of the Advisory Board, after discussing a number of provincial research schemes, the Board endorsed the following recommendations of the Committee to which the schemes were referred :—

- (i) That most of the important problems of potato growing in Northern India could be studied at a single central research station with provincial testing stations and that the question of the most suitable locality should be examined in detail and a preliminary scheme worked out.
- (ii) The possibility of an expedition to South and Central America preferably in co-operation with other parts of the Empire should be investigated ; the Committee suggested that the High Commissioner for India should be asked to bring the matter before the Executive Council of the Imperial Agricultural Bureaux.
- (iii) Dr. Hudson should be requested to ascertain what suitable *phytophthora-resistant*—varieties and other new material, could be obtained from the laboratory of the late Professor Baur and from the United States of America, Department of Agriculture (Plant Introduction Bureau).
- (iv) An attempt should be made to get some *Phytophthora-resistant* types and hybrids from Russia in exchange for seeds supplied from India.

2. The question of an expedition to South America has been held over pending an enquiry as to the amount of new material obtainable from three other sources, viz. :—

- (1) The Leningrad Institute of Plant Industry, U. S. S. R.
- (2) The United States Department of Agriculture (as a result of a recent expedition to South America).

(3) The late Professor Baur's laboratory in Germany.

(Dr. Hudson was to be invited to assist us in regard to the two latter.)

3. No reply has yet been received to our request for the supply of some of the new species of *Solanum* from the Leningrad Institute of Plant Industry in exchange for certain seeds which they have asked us to supply. A further communication has been sent recently and more definite information may be available when the Advisory Board meets. Dr. Hudson has succeeded in obtaining quite a large quantity of material from Professor Baur's laboratory in Germany and this is at present being kept in growing condition at Cambridge ; a list of the material is attached.

4. The American Department of Agriculture has promised to send any available material at the end of the present growing season.

5. Our attention has also been drawn to a recent hybrid between *Solanum tuberosum* and *Solanum demissum* obtained by Dr. Salanam at Cambridge which appears to be resistant to *Phytophthora*. It is hoped to obtain some material of this also.

6. Since the question was last discussed, the vacant post of the Second Imperial Economic Botanist has been filled by the appointment of Dr. Pal (previously Assistant Rice Research Officer in Burma) who was trained under Sir Roland Biffen and who is well acquainted with the potato-breeding technique in use at Cambridge. Dr. Pal has suggested that he should take up potato-breeding as one of his major lines of work and Dr. Shaw (Imperial Economic Botanist and Director, Imperial Institute of Agricultural Research) supports the proposal. Immediate accommodation can be given in the Botanical Section at Pusa for growing potatoes and other species of *Solanum* during the winter and the necessary equipment for protecting the new species against virus diseases, to which some of them are susceptible, can be arranged there.

7. The actual production of hybrids and seedlings will, doubtless, have to be done in the hills at some such altitude as 7,000 to 8,000 and a hill experiment station would be essential for breeding work. The most economical method of doing this would seem to be to arrange this station as a sub-station of the Imperial Institute of Agricultural Research taking advantage of whatever facilities the various provincial Departments are in a position to offer. In this connection, it may be mentioned that the Imperial Economic Botanist has recently made proposals for collaboration with Dr. K. C. Mehta (who is carrying out our rust research scheme) in the breeding of varieties of wheat definitely resistant to specific biological forms of rust. If these proposals are accepted by the Council they will involve renting a small area of land adjoining the Rust Research Laboratory at Simla. It has been ascertained that a plot of land of about 2 acres is available which can be obtained on rent. Dr. K. C. Mehta is both in favour of the above-mentioned scheme of collaboration in wheat-breeding and is also willing that the Assistant-in-Charge of the Simla Rust Laboratory, who remains here throughout the year, should as far as necessary supervise any potato-growing work. An Assistant would have to be sent by the Imperial Economic Botanist for planting and for all detailed work during the season.

8. The Officiating Director of Agriculture, United Provinces, has also informed me unofficially that there is every probability that facilities could be given at the enlarged Chaubattia fruit orchard (where the United Provinces fruit research is being carried out with the help of the Council's grant). At that place (elevation 6,500 to 6,800 feet) about 2 acres of land could be made available at once and something like 12 acres later on if required subsequently. Chaubattia would have the advantage that there will be stationed there, in connection with the fruit scheme, an Entomologist, Horticulturist and Soil Chemist. If land in Kumaon at a greater altitude is required, it could probably be obtained on rent in the Allen orchards near Ramgarh (7,500 to 8,000) but there would be no laboratory facilities there. It is also possible that we could obtain facilities for a small experiment at Muktesar which is equally high.

9. Viable potato seed has been obtained at Mashobra (elevation about 7,300), near Simla by the Punjab Agricultural Department, the elevation of the Rust Research Laboratory is approximately 7,000. The Punjab Department's experience however was that the neighbourhood of Simla was somewhat too wet for successful potato-growing and the same might apply to Chaubattia (Ranikhet). It is understood that the higher hills of the Kulu valley are now considered the most promising sites in the Punjab for potato culture but these places are not very accessible. It seems not unlikely that it may be necessary to carry out work at several centres with an elevation between 7,000 and 8,000 before it can be definitely settled where breeding work can best be done. Another important point requiring experiment is whether the seedlings can be grown at a plains station, if viable seed especially hybrids of known origin can be produced at a hill station. If this is feasible it would not only save time but would get away from many of the difficulties attending the growing of new varieties of potatoes in the hills where, due to unusual heavy rainfall valuable material is occasionally lost.

10. At every centre it will be necessary to provide some kind of cages to protect the breeding material from virus diseases. An inquiry has been made from Cambridge as to the special type of glass house used there. For work at Pusa cages of the type used in Sugarcane mosaic work may be more suitable; for the hills inexpensive glass houses like those used by Dr. Mehta for his rust work may be sufficient at the outset. This question is being examined further. It will be remembered that some of the South American Solanums mentioned by Bukasov do not grow under 'long day' conditions. To grow on the original material (for the production of hybrids, etc.), it will be necessary to grow these types in a green house where illumination can be controlled and one hill's station at least should be provided with a green house of this type and possibly also the plains station.

11. The Madras potato breeding scheme at Nanjanad on the Nilgiris is already in operation and Mr. Munro, the Deputy Director of Agriculture, under whose control the scheme has been placed, has informed me that he will be ready to receive new material from Cambridge for planting at Nanjanad in April next. Dr. Shaw is willing to plant low altitude forms at Pusa next October and the high altitude types could be planted at Simla and/or Chaubattia in April. There is thus every prospect that any new forms obtainable can be grown both in South India and in Northern India.

12. As regards the Northern India scheme, it appears to me that the most economic course would be to take advantage of the offer of the Imperial Economic Botanist to have this work undertaken in his section and to assist him to obtain the necessary sub-station in the Himalayas. In view of the uncertainty as to where potatoes will fruit best, it might be as well to start by making provision for a small staff and essential apparatus, etc., and to take advantage of all temporary facilities which the various provinces can offer.

It is hoped that rough estimates will be ready by the time the Committee meets.

The Director of Agriculture, Bengal, has offered facilities at Kalimpong and the Director of Agriculture, United Provinces, at Jeolkote below Nainital so that facilities at low altitude hill stations for testing for multiplication will be available. Both these stations are about 3,500 feet which seems too low for breeding work.

B. C. BURT.

8th August 1934.

*List of material obtained by Dr. P. S. Hudson from Prof. Baur's
Laboratory in Germany.*

Südamerikanische Kartoffeln an P. Hudson, Frühjahr 1934.

	System. Bezeichnung.	Name.	Herkunft.
D 440	Sol. curtilobum ..	papa Luqui ..	La Paz Markt.
D 447	Do. ..	Do. ..	Laja Markt.
D 380	Do. ..	.. ..	kultiviert in La Quiaca. 3500 m u. d. M.
D 1683	Do. ..	Luqui ..	Cuzco Markt.
E 1445	Sol. ajanhuiri ..	Ajahuieri ..	.. ..
D 366	Sol. phureja ..	Pureja ..	.. ..
D 846	Sol. Kessalbrenneri ..	.. ..	Bogota Markt.
D 930	Do. ..	papa Criolla hueva ..	Bogota Versuchsstat.
D 806	Do. ..	.. ..	Tulcan Markt.
D 1695	Do. ..	.. ..	Peru oder Columbien.
D 934	Do. ..	papa Chaucha ..	Bogota Versuchsstat.
D 821	Do. ..	.. ..	Pasto Markt.
D 807	Do. ..	.. ..	Tulcan Markt.
E 1344	Sol. tuberosum ..	Cochamo ..	Huillanco, Chiloé.
E 1348	Do. ..	Zapatona ..	Do.
E 1357	Do. ..	Cabra ..	Rio Rahue Chiloé.
E 1359	Do. ..	Corahila ..	Fundo Quilan Chiloé.
E 1361	Do. ..	Cordillera ..	Fundo Piruquina, Chiloé.
E 1368	Do. ..	verwilderte Kartoffeln ..	El Roble bei Huillanco, Chiloé.
E 1370	Do. ..	Cordillera ..	Fundo Piruquina, Chiloé.
E 1372	Do. ..	papas indigenas ..	Huillanco, Chiloé.

System. Bezeichnung.			Name.	Herkunft.
E 1374	Sol. tuberosum ..	..	papa Huevo Eierkartoffel.	.. Insel Calbuco, Chiloé.
E 1376	Do. ..	..	Costa ..	.. Chenich Chiloé.
E 1377	Do. ..	..	Camotilla ..	.. Do.
E 1392	Do. ..	..	Blanca Tripainin	.. Insel Chaulec Chiloé.
E 1402	Do. ..	..	Hamburguesa ..	.. Aldachilda Insel. Lemui Chiloé.
E 1403	Do. ..	..	Rosadina ..	.. Insel Cailin Chiloé.
E 1404	Do. ..	..	Siete Semanas ..	.. Insel Alao Chiloé.
E 1414	Do. ..	..	Americana ..	.. Insel Caguache Chiloé.
E 1417	Do. ..	..	Rosada ..	.. Insel Goldita.
E 1418	Do. ..	..	Americana ..	.. Insel Quenao.
E 1444	Do. ..	..	Quellas. ..	.. Chiloé.
D 884	Sol. andigenum ..	..	.. ..	.. Riobamba Markt.
D 1706	Do. ..	..	.. ..	.. Ambatos Markt.
D 1624	Do. ..	..	.. ..	.. La Paz Markt.
D 1627	Do. ..	..	.. ..	.. La Paz Markt.
D 514	Do. ..	..	.. ..	.. Sorata Markt.
D 560	Do. ..	..	.. ..	.. Huancayo Markt.
D 1626	Do. ..	..	.. ..	.. La Paz Markt.
D 1020	Do. ..	..	acochlia ..	.. Cuzco Markt.
D 896	Do. ..	..	papa dominga ..	.. Ambatos Markt.
D 1239	Do. ..	..	papa Jalcahuarmey	.. Callejon de Huaylas 3,000 m.
D 1016	Do. ..	..	pocataochle ..	.. Cuzco Markt.
D 787	Do. ..	..	"Handelssaat"	.. Do.
D 518	Do. ..	..	.. ..	.. Sorata Markt.
D 682	Do. ..	..	.. ..	.. Lima Markt.
D 1720	Do. ..	..	.. ..	.. Cuzco Markt.
D 406	Do. ..	..	.. ..	.. La Paz Markt.
D 533	Do. ..	..	.. ..	.. Sumata 60 km nördl. von Sorata. 2,500 m ü. d. M. feucht.
D 546	Do. ..	..	.. ..	.. Sumata (s. D 533).
D 1687	Do. ..	..	.. ..	.. Tulcan Markt.
D 1070	Do. ..	..	Coompis ..	.. Ppisaco bei Cuzco.
D 1640	Do. ..	..	.. ..	.. aus Copacabana Guaqui Markt.
D 504	Do. ..	..	.. ..	.. Sorata Markt.
D 532	Do. ..	..	.. ..	.. aus Sumata 60 km nördl. v. Sorata. 2,500 m ü. d. M. feucht.
D 951	Do. ..	..	huila taraco ..	.. Curupamapa Acker l.
D 901	Do. ..	..	papa paucha ..	.. Ambatos Markt.
D 1681	Do. ..	..	.. ..	.. Lima Markt.
D 786	Do. ..	..	Handelssaat ..	.. Cuzco Markt.
D 1719	Do. ..	..	Coompis ..	.. Do.

System. Bezeichnung.				Name.		Herkunft.	
D 1721	Sol. andigenum	..	..	Ceompis	..	..	Cuzco Markt.
D 1025	Do.	..	..	Pucamama	..	..	Do.
D 1098	Do.	..	..	..	..	..	Huacconco b. Cuzco, 3320 m.
D 1651	Do.	..	..	Ajahuri	..	..	La Paz Markt.
D 390	Do.	..	..	papa monda	..	..	Do.
D 925	Do.	..	..	papa negra	..	..	Quito Markt.
E 1515	Do.	..	..	..	..	..	unbekannt.
D 847	Do.	..	..	..	..	..	Bogota Markt.
D 1293	Do.	..	..	Leona Chilca	..	..	Quito.
D 823	Do.	..	..	..	..	..	Pasto Markt.
E 1303	Do.	..	..	papa "Cormé"	..	..	Callejon d. Huaylas Prov. d. Huaraz, 3200 m.
D 1658	Do.	..	..	..	..	..	Achicachi Markt. (Alto plano).
D 1662	Do.	..	..	..	..	..	Sorata Markt.
D 1209	Do.	..	..	papa ojosa	..	..	Santa Cruz Sta Victoria.
D 1004	Do.	..	..	..	..	..	Ursi bei Cuzco.
D 946	Do.	..	..	..	..	..	Ilabaya Markt.
E 1747	Do.	..	..	..	..	..	Pic Illampu.
D 873	Do.	..	..	Secha	..	..	La Paz.
D 1699	Do.	..	..	..	..	..	Riobamba Markt.
D 1226	Do.	..	..	..	..	..	Tupiza.
E 1325	Do.	..	..	pulo negro	..	..	Cochipata Pic Illampu.
D 1647	Do.	..	..	..	..	..	Tiuhuanacu.

APPENDIX LXIV-A.

SUPPLEMENTARY NOTE, DATED THE 3RD SEPTEMBER 1934, ON SUBJECT No. 55, POTATO BREEDING SCHEME FOR NORTHERN INDIA. (ADDITIONAL NOTE BY AGRICULTURAL EXPERT).

As promised in my previous note (Appendix LXIV) a rough provisional estimate which has kindly been supplied by Dr. Shaw is attached.

B. C. BURT,
Agricultural Expert.

SIMLA ;

The 3rd September 1934.

Draft Potato Breeding Scheme for Northern India.

It is unnecessary to point out the importance of this crop and perhaps equally unnecessary to draw attention to the compulsive need for its improvement. The present position of potato growing is unsatisfactory, it might be said, not only in India but throughout the world. All the potatoes in general cultivation outside South America appear to have been derived from one or two varieties that were introduced into Europe in the 16th century. With such poverty of initial breeding material it is scarcely surprising that little progress was made with the vital problems relating to resistance to virus diseases, *Phytophthora*, frost resistance, and so on. But with the discovery by the Russian expedition to South America—and the succeeding American and German expeditions—of a large number of both wild and cultivated species, some of them possessing exceedingly valuable characters from the breeding viewpoint, the outlook has been changed entirely and it does not seem too much to hope that some at least of the problems of potato breeding will be solved in the not distant future.

In India the potato grower, especially in the plains, has to contend with a number of disadvantages. During the hot season, he loses the greater part of his stock owing to the ravages of the potato moth and to several "rots" caused by fungi and bacteria; no really satisfactory method of storage which is at the same time commercially practicable has yet been evolved. Again, after one or two seasons in the plains potato varieties appear to 'degenerate'—doubtless due to virus diseases—and the cultivator has to obtain a fresh supply from the hills, paying heavy freight for his seed. The grower in the hills has his troubles too; thus, for instance, he is continually menaced with the late blight caused by *Phytophthora infestans*, from whose ravages the crop in the plains is generally free. Another problem is that created by the existence of dormancy—tubers appear normally to require a resting period of about two months or so before they will germinate and so tubers from one crop cannot be used as seed for a crop sown soon after. Thus in those parts of the Punjab where two crops in the year are taken, tubers from the autumn crop cannot be used for sowing the following spring crop and similarly the tubers from the higher hills where the summer sowing is done comparatively late in the year to avoid the risk of damage by frost in the early months, cannot be utilized for the winter crop in the plains.

It is clear that there are many difficulties to be surmounted and many recondite problems to be solved. The most feasible method of doing so appears to be to initiate a scheme of research and breeding, by providing a central station in the plains and a breeding sub-station in the higher hills where the temperature is more favourable for flowering and seed-setting. The many facilities available at the Imperial Institute of Agricultural Research, Pusa, recommend its adoption as the plains station and preliminary observations at a number of places in the hills would decide the best site for the high elevation sub-station. Work could be commenced at Pusa this autumn and in the hills next spring.

Estimates for the cost of such a scheme which would be for a 5-year period in the first instance, are attached. Later on a multiplication station in the foot-hills may be necessary.

The broad outlines of the work would be :—

- (1) The collection and classification of the varieties grown in India paying particular attention to 'Desi' varieties.
- (2) The study of the available South American material to discover the forms most likely to be of value as parents for crossing, under Indian conditions.
- (3) The production of new varieties with desirable characters such as immunity or high resistance to blight and virus diseases, etc., by selection from seedlings and by hybridization.
- (4) The study of flowering, fertility and sterility, and other related problems a sound knowledge of which is essential if object (3) is to be achieved.
- (5) The study of the problems of dormancy and storage.
- (6) Genetical studies and investigations of any other problems that may arise.

POTATO BREEDING SCHEME.

Estimate of costs.

	Rs.
<i>Non-recurring—</i>	
(1) At Pusa—	
a Insect-proof house	2,500
b Pots	300
c Wire baskets for storing potato samples ..	250
(2) At hill station—	
d Land	} Depends on site, can perhaps be rented.
e Quarters for staff	
f Bullock shed	
g Laboratory and office	10,000
h Seed and implement godown	2,000
k Fencing	2,000
l Office furniture	500
m Insect-proof house	} 6,000
n Controlled illumination house	

Carried over

POTATO BREEDING SCHEME—*contd.**Estimate of costs—contd.*

	Rs
o Laboratory apparatus (microscope, etc.) ..	1,500
p Racks for storing potatoes ..	500
r Wire baskets for keeping samples separate ..	250
s Implements (ploughs, etc.) ..	300
t Pots ..	300
x Sprayers ..	200
y Pollination bags ..	100
z Gunny bags ..	50
q Books ("Potato varieties" by Salaman, Fisher's Statistics, etc.) ..	100
v Bullocks (2 pairs) ..	500
Total ..	<u>27,350</u>

Recurring—

At hill station—

Pay of Assistant at Rs. 150 ..	1,800
Pay of Clerk and Store-keeper at Rs. 50 ..	600
Pay of Fieldman at Rs. 40 ..	480
Pay of Mali at Rs. 25 ..	300
Pay of Peon at Rs. 15 ..	180
Pay of chowkidar at Rs. 15 ..	180
Labour ..	2,000
T. A. for Assistant, etc. ..	500
Chemicals ..	200
Manures ..	200
Feed and upkeep of bullocks ..	100
Seeds ..	100
Stationery, postage ..	150
Miscellaneous ..	200
Total ..	<u>6,990</u>

For 5 years $6,990 \times 5 = 34,950$.

(To this rent may have to be added.)

	For 5 years. Rs.
Non-recurring ..	27,350
Recurring 6,990 ..	34,950
Total ..	<u>62,300</u>

To this would have to be added *either* the cost of land and certain buildings,

or

Rent for land and buildings.

APPENDIX LXV.

NOTE, DATED THE 21ST JUNE 1934, ON SUBJECT No. 58, APPLICATION FROM GOVERNMENT OF THE CENTRAL PROVINCES, FOR A GRANT OF RS. 46,200 SPREAD OVER A PERIOD OF 4 YEARS FOR A SCHEME OF RESEARCH WORK ON PAN CULTIVATION.

Attention is invited to the attached note (Enclosure I), dated the 22nd January 1934, on the subject noted above which was circulated to the Advisory Board for consideration at its meeting held in February 1934. The Board decided (*vide* extracts from its Proceedings at Enclosure II) to refer the scheme to a Committee of the Board, the personnel to be selected by the Chairman as usual, with instructions that its report should be submitted in time for consideration at the Board's next meeting in Simla. It was also decided that information regarding the work already done should be furnished to the Council. The Director of Agriculture, Central Provinces, has now forwarded the attached notes (Enclosure III) containing the required information.

2. The Chairman of the Advisory Board has accordingly constituted the undermentioned Committee to examine the scheme in question :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, *Chairman*, *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. The Director of Agriculture, Madras.
4. The Director of Agriculture, Bombay.
5. The Director of Agriculture, Bengal.
6. The Director of Agriculture, United Provinces.
7. The Director of Agriculture, Bihar and Orissa.
8. The Director of Agriculture, Central Provinces.
9. A mycologist from the Imperial Institute of Agricultural Research, Pusa.

Rai Sahib Malik Charan Das, Secretary, Imperial Council of Agricultural Research, *Secretary*, *ex-officio*.

3. The Committee will meet during the next session of the Advisory Board, on an afternoon, which will be fixed later to meet the convenience of members, between the 3rd to 8th September 1934.

4. The Report of the Committee will be circulated to the Advisory Board in due course.

For the use of members only.

ENCLOSURE I.

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ADVISORY BOARD, NINTH MEETING, FEBRUARY 1934.

SUBJECT No. 12.

APPLICATION FROM THE GOVERNMENT OF THE CENTRAL PROVINCES, FOR A GRANT OF Rs. 46,200 SPREAD OVER A PERIOD OF FOUR YEARS FOR A SCHEME OF RESEARCH WORK ON "PAN CULTIVATION".

Attention is invited to the attached letter from the Government of the Central Provinces, No. 48-1052-XIV, dated the 8th January 1934 (Annexure I) and the extract from a letter from the Director of Agriculture, Central Provinces, No. 5551, dated the 12th|15th December 1933 (Annexure II) forwarded therewith.

The Scheme (Annexure III) involves a non-recurring expenditure of Rs. 6,400 and recurring expenditure of Rs. 39,800 or a total expenditure of Rs. 46,200, spread over a period of four years. As against this it is expected that a sum of Rs. 25,600 will be realised by way of profits which should be credited to the funds of the Council. This will reduce the grant asked for from the Council to Rs. 20,600 spread over four years.

The scheme is for the consideration of the Advisory Board.

CHARAN DAS,

Secretary.

NEW DELHI ;

The 22nd January 1934.

ANNEXURE I.

EXTRACT FROM LETTER FROM THE REVENUE SECRETARY, GOVERNMENT OF THE CENTRAL PROVINCES, AGRICULTURE DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 48|1052-XIV, DATED THE 8TH JANUARY 1934.

Grant-in-aid from Imperial Council of Agricultural Research for certain schemes of research in the Central Provinces.

I am directed by the Government of the Central Provinces (Ministry of Agriculture) to forward a copy of letter No. 5551, dated the 12th|13th December 1933, from the Director of Agriculture, Central Provinces, together with the undermentioned six schemes and to recommend them for the favourable consideration of the Imperial Council of Agricultural Research. The schemes are being printed and 150 copies of them will be furnished to you in due course

* * * * *

(6) Scheme for research on the Pan Cultivation (Annexure III).

2. These schemes have been considered by the Provincial Agricultural Research Committee on the 9th December 1933 and approved by that body. The local Government has also accepted them. I am accordingly

to request that they may be placed before the Advisory Board of the Imperial Council of Agricultural Research at its next meeting to be held in February 1934.

ANNEXURE II.

COPY OF LETTER FROM THE OFFG. DIRECTOR OF AGRICULTURE, CENTRAL PROVINCES, TO THE SECRETARY TO GOVERNMENT, AGRICULTURE DEPARTMENT, No. 5551, DATED THE 12TH/15TH DECEMBER 1933.

I have the honour to attach herewith six schemes of research which were placed before the Provincial Agricultural Research Committee on the 9th December 1933 and recommended for transmission to the Imperial Council of Agricultural Research for the provision of funds. The Provincial Agricultural Research Committee placed them in the following order of importance :—

Schemes for Research on the Orange Crop.	}	A.
Schemes for Research on the Oilseeds.		
Schemes for Research on the Potato Storage.	}	B.
Schemes for Research on the Gangai pest of Rice.		
Schemes for Research on the Sann Hemp.	}	C.
Schemes for Research on the Pan cultivation.		

* * * * *

2 The cultivation of the Betel vine in India is not confined to one province only and the results acquired will be of value elsewhere. Pan growing is a specialized vocation but the money invested in the industry is very considerable and the losses from disease enormous. Controlled experiments in cultivation and treatment are essential if reliable results are to be gained. If this scheme is rejected by the Imperial Council of Agricultural Research, I wish to commend it to Government as a Provincial undertaking. It will be noticed that it is expected to be run at considerable profit and in addition to dealing with the several diseases of the plant, we shall acquire, a large amount of information regarding the crop and its cultivation, about which we know very little at present.

ANNEXURE III.

SCHEME ON PAN CULTIVATION.

This province produces or at least has produced in the past, a very large quantity of "pan" annually; but on account of the incidence of disease pan cultivation has completely been abandoned in many parts of the province, *e.g.*, Ramtek, Drug, Saugor, etc. Since it is not only one disease that makes pan cultivation uneconomical in various parts of the province, remedial measures have to be tried for the control of diseases where they occur. A few attempts in the past have been made to study remedial measures for the control of these diseases, *e.g.*, in Ramtek it has been shown that foot-rot can be controlled by treating the soil systematically with Bordeaux Mixture; at Timarni there are two diseases, *viz.*, anthracnose and foot-rot, and they can be also controlled by the use of proper fungicides. At Piparia and Saugor our trials for the control of

pan diseases were unsuccessful. The reason may be that there may have been more organisms than one infecting the crop and the remedy found effective for controlling foot-rot caused by *Phytophthora* was not useful against foot-rot caused by some other organism.

For the study of the causes of pan disease and for evolving suitable remedial measures a continuity of experiments for a period of years is essential ; and this continuity cannot be ensured unless the department has pan gardens in different districts. A pan garden to give any reliable results must be not less than three-fourth of an acre at least and since the cost of starting a garden on this scale is rather prohibitive under our present financial conditions, I suggest that the Imperial Council of Agricultural Research be approached for a grant to start pan gardens in the following places, each garden to be of one acre :—

(1) Richai (Adhartal).

(2) Silari.

(The Deputy Director of Agriculture, Northern Circle, proposes to start two small gardens of the two places at the end of this cold weather.)

(3) Saugor.

(4) Nagpur.

(5) Ramtek.

(6) Bhanduk.

(7) Drug or Raipur.

(8) Drug or Raipur.

The recurring and non-recurring expenditure will vary from place to place but approximately the non-recurring expenditure for a garden of one acre will be Rs. 800 for a period of four years and recurring expenditure will be approximately Rs. 800 per year. Therefore in four years the total expenditure will be Rs. 4,000.

If we have these gardens we cannot only investigate the pathological side of the problem but also agricultural. This latter problem can be studied by the Deputy Director of Agriculture in whose circle the garden is situated and his agricultural assistant in the district can look after the garden.

For the study of the pathological problem a special assistant under me will be required on Rs. 150 per month for four years with an annual increment of Rs. 25 ; he will need a travelling allowance of Rs. 300 a year and my travelling allowance grant will also need to be increased.

For the experiments an annual recurring grant of Rs. 1,000 will be required. The total expenditure for eight gardens for four years will be Rs. 46,200. A healthy garden normally shows a net profit of about Rs. 800 per acre annually. That is the eight gardens will bring a net profit of Rs. 6,400 per year. After meeting the extra cost for the pay of a special assistant his travelling allowance and agricultural experiments from this profit, a large surplus will be available.

J. F. DASTUR.

*Mycologist to Government,
Central Provinces,
Nagpur.*

ENCLOSURE II.

EXTRACT FROM THE PROCEEDINGS OF THE ADVISORY BOARD MEETING HELD
ON 19TH FEBRUARY 1934.

13. *Application from the Government of the Central Provinces for a grant of Rs. 46,200 spread over a period of 4 years for a scheme of research work on pan cultivation (Subject No. 12 of the Agenda).*

Mr. Ritchie introduced the scheme. Dr. Burns and Rao Bahadur Ananda Rao said that some work on *pan* cultivation and diseases had been done in Bombay and Madras respectively. Dr. McRae described the work done at the Pusa Research Institute on *pan* diseases in Bengal and Bihar and mentioned the three principal diseases which were prevalent in the monsoon, winter and summer respectively. He stressed the need for having a *pan* garden under the investigator's own control. Mr. Burt suggested that this subject be referred to a committee of the Advisory Board, the personnel to be selected by the Chairman as usual. This suggestion was approved and it was decided that the committee should meet before or on the occasion of the next Advisory Board meeting and should submit its report at that meeting. Meanwhile, information in regard to the work already done should be furnished to the Council's secretariat.

* * * * *

ENCLOSURE III.

NOTE BY THE DIRECTOR OF AGRICULTURE, CENTRAL PROVINCES.

A certain amount of work has been carried out on diseases of *pan* in other Provinces besides the Central Provinces, especially Bengal and Bombay.

In Bengal the chief problem has been the control of sclerotial diseases and in Bombay of the disease caused by *Phytophthora*.

In the Central Provinces *pan* is attacked by (1) two members of the *Phytophthoraceae*, (2) sclerotial fungi like *Rhizoctonia bataticola*, *R. Salani*; *Sclerotia Rolfsii*, etc., and (3) anthracnose caused by *Gloeosporium* sp., *Colletotrichum* sp. and *Vermicularia* sp. Therefore the problems of the Central Provinces are more varied than those of either Bengal or Bombay. Central Provinces were the first to show that *Phytophthora* could be controlled by treating the soil with Bordeaux Mixture and later Bombay confirmed our results. Even if in the Central Provinces there were no other disease of *pan* than that caused by *Phytophthora* still there would be a necessity for further study of this disease because what we now want to find out is what are the minimum strength of the fungicide, the minimum quantity and the minimum number of applications required. Another problem that requires to be investigated is which is the best method of irrigation and cultivation and which method influences most the incidence of disease. In these Provinces the methods of cultivation and irrigation vary considerably from place to place.

As regards the incidence of the many diseases of pan it is essential to know at what time of the year a particular disease caused most damage and if climatic conditions influence its incidence.

In these Provinces the varieties of pan chiefly cultivated are Bangla and Kapoori ; other varieties, such as Gangeri, are also cultivated but not to the same extent as the former two. Therefore another problem that would be investigated is the problem of finding out suitable resistant varieties.

Thus even though some work has been done in other Provinces and in this Province, still much work requires to be done and the further work that we propose to do is in no sense "duplication of work already done".

APPENDIX LXVI.

NOTE, DATED THE 5TH SEPTEMBER 1934, ON SUBJECT No. 64, PROVINCIAL SCHEMES FOR THE APPOINTMENT OF STAFFS IN CONNECTION WITH THE SCHEME FOR THE IMPROVEMENT OF MARKETING IN INDIA.

At its meeting held in August 1933, the Advisory Board discussed certain proposals based on the recommendations of the Royal Commission on Agriculture in India and the Central Banking Enquiry Committee in regard to the improvement of marketing of agricultural produce in India, and recommended, *inter alia* the appointment of a Marketing Expert and the necessary assistance and establishment to deal with the problem of marketing of selected commodities. The recommendation of the Board was accepted by the Governing Body, and Mr. A. M. Livingstone of the English Ministry of Agriculture has been appointed Marketing Expert for a period of three years.

The question of marketing was also discussed at the recent Provincial Economic Conference and the Government of India decided to embark on a comprehensive marketing programme to be carried out by the Imperial Council of Agricultural Research.

2. The scheme which has been prepared by the Marketing Expert and discussed at the meeting of the Crop Planning Sub-Committee of the Advisory Board held in June, 1934, and also departmentally provides, among other things, for the appointment of a Central Staff (*viz.*, 5 Senior Marketing Officers, 2 Marketing Officers and 10 Assistant Marketing Officers and the necessary office establishment) and a *nucleus* staff in the various provinces (*viz.*, 3 Assistant Marketing Officers and the necessary office establishment per province) to be paid by the Council for a period of five years subject to the availability of funds. A maximum annual grant of Rs. 20,000 has also been fixed for all provinces other than N. W. F. P., and Assam, each of which has been allotted a maximum sum of Rs. 10,000 per annum. It was also agreed at the meeting of the Crop Planning Sub-Committee that provision should be made for Sind as for a separate major province.

3. The position was explained to the local Governments in detail and they were called upon to submit proposals for the consideration of the Advisory Board, *vide* the circular letter No. F. 9-M. (2)/34, dated the 2nd August 1934, (Enclosure I). As a result of this, schemes have been received in respect of Bombay, Sind, Bengal, United Provinces, Central Provinces, Punjab, Bihar and Orissa, N.-W. F. P., and Assam, and these are circulated (Enclosure II). It is understood that the Madras Government have also despatched a scheme for this meeting of the Advisory Board, but it has not arrived in time. A summary (Enclosure II) of the proposals has therefore been obtained from the Director of Agriculture, Madras, to serve as a basis of discussion. Burma Government has promised to send in a scheme later.

4. The Advisory Board has appointed a Sub-Committee to consider the various provincial schemes in the first instance. The report of the Sub-Committee will be submitted to the Board.

5 It may be added that with a view to making the scope of the scheme of an all-India character, it was considered desirable to invite the

co-operation of the Local Administrations, and States. A copy of the letter that has been addressed to the former and a copy of a draft letter that is being issued to the latter by the Foreign and Political Department at the instance of the Council are also attached for the information of the Board (Enclosures III and IV.)

ENCLOSURE I.

LETTER TO ALL LOCAL GOVERNMENTS, No. F. 9-M. (2)|34, DATED THE 2ND AUGUST 1934.

SUBJECT :—*Scheme for the improvement of marketing in India.*

I am directed to refer to the letter from this Department, No. D.-696|A.33, dated the 15th July 1933, on the above subject.

2. At the Provincial Economic Conference 1934 there was general agreement that of all practicable measures for improving economic conditions an intensive programme to develop marketing facilities for agricultural products (both crops and animal products) offers the best immediate prospects of substantial results.

The action to be taken to deal with the main marketing problems includes propaganda and the supply of information in external markets regarding Indian Products ; the grading, sorting and bulking of the main staple products ; special market organisations for perishable commodities ; information to India's producers of consumers' requirements both in India and abroad ; the planning of production on the basis of quality and demand ; the establishment and development of regulated markets ; the undertaking of market surveys for the purpose of developing a common plan throughout India, the establishment of properly organised ' futures ' markets, commodity exchanges and warehouses.

3. In accordance with the Finance Department Resolution No. F.16 (1)-F.34, dated the 5th May 1934, the Government of India have decided to proceed on the lines of the programme provisionally approved at Provincial Economic Conference 1934 which included the following initial steps, viz. :—The appointment of a Central Marketing Officer by the Government of India, the appointment of Provincial Marketing Officers, the inauguration of marketing surveys, the appointment of special Committees for staple crops (starting with oilseeds and tobacco) and work on grade standards. These recommendations in regard to marketing broadly follow the recommendations of the Royal Commission on Agriculture which were generally endorsed by the Banking Enquiry Committee. The subject therefore has already received careful consideration and the present proposals have been framed by the Imperial Council of Agricultural Research to give effect to the recommendations of the Conference.

4. The Government of India have also decided to provide the Imperial Council of Agricultural Research Department with funds for the establishment of a Central Marketing Staff and to provide also for a period of five years for the expenditure by Local Governments on a nucleus provincial marketing staff to the extent of approximately a total of 27 marketing officers of a junior Grade.

The Marketing Expert appointed by the Imperial Council of Agricultural Research has therefore prepared a general scheme which has since

been the subject of discussion and revision departmentally and at an informal meeting of a sub-committee of the Advisory Board which met at Simla for the Crop Planning Conference in June last.

5. *Programme*.—As soon as the Central Marketing Staff and a Marketing Staff in each of the provinces have been appointed a start will be made with a marketing programme covering investigation and development work as well as work on grade standards.

The proposed *investigation work* includes a series of marketing surveys with immediate reference to the more important commodities grouped as follows :—

I. *Crops*.—(a) Cereals (wheat and rice), (b) Oilseeds (groundnuts and linseed), (c) Plantation and special crops (Tobacco and fruit).

II. *Animal Husbandry Products*.—(a) Dairy Products, etc. (Milk and Butter, Eggs and Poultry), (b) Livestock, etc. (Hides, Skins and Wool, Livestock and Fish).

The *Development work* generally will aim at securing the more extensive use of agreed commodity standards and the better organisation of producers for marketing purposes. This work will be done in the provinces and will probably fall mainly on provincial marketing staffs.

The *work on grade standards* will be largely of a technical character relating to the chemical and physical characteristics of such products as oilseeds, grains, fruit, etc., and for the testing of grading technique and equipment under practical conditions.

Staff and other requirements.

(a) *Central Marketing Staff*.—In addition to the Marketing Expert, who has already taken up his duties, the following staff is considered necessary :

Five Senior Marketing Officers ; two Marketing Officers and ten Assistant Marketing Officers, who will be in charge of work on the various commodities and groups of commodities referred to above and will work in close co-operation with Provincial Marketing Officers.

(b) *Provincial Marketing Staff*.—It is hoped that each Provincial Government will endeavour to appoint a Marketing Staff fully adequate to the needs of the province. In order to obtain tangible results at an early date however and to ensure a uniform rate of progress in the provinces and throughout India as a whole, it is proposed, subject to the necessary funds being voted and placed at the disposal of the Imperial Council of Agricultural Research, that part of the cost of Provincial Marketing Staffs represented by the salary and travelling expenses of 27 Assistant Marketing Officers will be met from Central Funds for a period of five years only.

As has been explained the work will commence with 5 main groups, including 14 separate commodities and it is proposed to assist individual provinces in overtaking the work by making provision from central funds for the appointment in each province of at the most three Assistant

Marketing Officers, provision being made for Sind as for a separate province for this purpose. The average salary of these Officers should not exceed that proposed for Central Assistant Marketing Officers and the total expenditure chargeable to the Imperial Council of Agricultural Research's grant—including travelling expenses and office establishment—should not exceed Rs. $\frac{20,000^*}{10,000^\dagger}$ per mensem.

The Provincial Marketing Officers will be expected to co-operate in the work in accordance with a detailed general scheme for each commodity to be drawn up by the Central Marketing Staff.

6. The persons appointed as Assistant Marketing Officers in the provinces should be accustomed to a rural environment and show an aptitude for agriculture. They should possess a University Degree in Agriculture, Veterinary Science, Commerce or Economics or the M. R. C. V. S. Diploma or be graduates or licentiates of an Indian Agricultural or Veterinary College or hold the Indian Dairy Diploma. Only in very exceptional cases should these academic qualifications be waived and in every case it would be desirable that the person selected should have had practical or commercial experience or have done marketing survey work in connection with one of the commodities referred to. Attention is also drawn to the enclosed statement of general considerations regarding the appointment of a Provincial Marketing Staff and to the supplementary note setting out the nature and scope of a marketing survey.

7. It will be understood that the above proposals are contingent on the necessary funds being duly voted and placed at the disposal of the Imperial Council of Agricultural Research but meantime I am to invite the Government of _____ to submit proposals for marketing staffs, to be attached to the Director of Agriculture or Director of Veterinary Services as the case may be, within the limits and on the general lines indicated above. It is desired to adjust details to suit provincial needs to the fullest extent compatible with the All-India character of the main scheme. It is desired to place all these schemes before the Advisory Board of the Council during its next meeting on September 3rd to 8th 1934.

8. I am to explain that before a scheme for the appointment of a Provincial Marketing Staff is finally sanctioned by the Council, it is intended that the Marketing Expert should have an opportunity of visiting and discussing the scheme with the Local Government and its Officers. In the meantime, however, the submission of a draft scheme as suggested will greatly assist in expediting work and I am to request that the detailed proposals of the Government of _____ on the subject may kindly be forwarded to this Department as early as possible to enable them to be circulated to the Advisory Board.

9. In conclusion I am to add that the question of appointing the special Committees for oilseeds and tobacco referred to in paragraph 3 of this letter will form the subject of a separate communication.

*To all other than N.-W. F. P. and Assam.

†To N.-W. F. P. and Assam.

Statement of general considerations regarding the appointment of Provincial Marketing Staffs.

It is suggested that in connection with the appointment of a marketing staff Provincial Governments may have in view the following considerations :—

(1) The necessity of ensuring that any marketing Officers appointed are practical men accustomed to a rural environment and with an aptitude for agriculture. They should have technical or commercial experience and a knowledge of farm production in addition to their other qualifications.

(2) The number and importance of those products, produced in the province, which are included within the scope of the proposed All-India Marketing Surveys. (Provision should be made for dealing with animal husbandry products as well as crops.)

(3) It is contemplated that the maximum provision which can be made from Central Funds to any one Province will be in respect of three Marketing Officers of a junior grade (including clerical assistance and travelling expenses) and that could only be provided in full for those provinces wherein most of the commodities specified are produced on an extensive scale.

(4) The work of collecting the particulars and information required regarding the marketing surveys, so far as it relates to provincial conditions, will involve briefly :—

(a) Visits to villages and markets in the main centres of production and numerous interviews with producers, merchants, manufacturers, transport and market representatives and others regarding their practice and methods of business in connection with the marketing of each commodity.

(b) The examination and differentiation, in plain and precise technical terms, of the various qualities of each product, collecting samples, describing and photographing various processes and methods of marketing, grading, packing, etc.

(c) Accounting, within a reasonable degree of accuracy, for all the supply of each product produced in the province by indicating its subsequent destination and method of utilisation and describing the routes and channels of trade followed by such produce.

(d) Collecting from producers and from market authorities, trade or official sources information regarding producers', wholesalers' and consumers' prices weekly, monthly and annually and collecting also information regarding the amount and causes of price margins, differences, fluctuations and variations.

(e) At a later date the demonstration and supervision of standards and the organisation of marketing generally will form part of the work. But action on those lines should be deferred until the preliminary marketing surveys have been completed and are available as a sound basis of development.

The formation of marketing organisations should not therefore be regarded as among the immediate duties of Provincial Marketing Officers. They should rather concentrate on investigation and standardisation work.

The marketing programme submitted by each province should cover all the following groups of commodities or such of them as are produced in the Province :—

Cereals, Oilseeds, Plantation and Special Crops, Dairy Produce and Livestock Products.

(5) The complete range of commodities concerned should be allocated among the marketing officers and each officer should so far as possible be allotted allied products which are produced in the same areas or which follow the same trade channels. Arrangements should be made also for including within the purview of Marketing Officers the trade of lesser Indian States lying within or contiguous to the borders of the province.

(6) It is intended that, subject to the supervision of the Marketing Expert, the Central Marketing Officer concerned with each group of commodities should prepare in detail an outline scheme of investigation for the benefit of Provincial Marketing Officers and in case of difficulty he will visit provinces and lend his personal assistance to the local Marketing Officer.

It is hoped that the common interests of the provinces and the all-India significance of the work will not be lost sight of. It will be desirable, therefore, to maintain close relations between the Provincial and Central Marketing Staffs in order to afford mutual assistance and to arrive at the greatest possible degree of co-operation and co-ordination.

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, ADVISORY BOARD, SUB-COMMITTEE ON CROP PLANNING, JUNE 1934.

SCHEME FOR THE IMPROVEMENT OF MARKETING IN INDIA (SUPPLEMENTARY NOTE).

Note by Mr. A. M. Livingstone on 'Marketing Surveys of Indian Agricultural Produce'.

The object of these surveys is to present a complete picture in detail of the marketing of each commodity in all stages from the producer to the final consumer. The pattern must naturally be a composite mosaic, constructed by fitting in the facts of each Province and State into an all-India picture, which must in turn be placed in its proper relation to a picture of world conditions in respect of the marketing of the particular commodity concerned. A marketing survey when completed should present a broad view, accurate in every detail, and should form a sure foundation for the intelligent planning of future development.

The following general outline indicates the nature and scope of a marketing survey. This would however be subject to modification in detail so as to fit the circumstances of any particular crop or animal husbandry product.

A. Supply.

- (1) General world position—production—international trade—world trade regulation of supplies by international agreement, etc.—
- (2) Indian Supplies—combined and by provinces—
 - (a) Home produced—Trend of production—Yield per unit—Quantity sold by producers—Season of marketing—Effect of natural conditions (*e.g.*, monsoon).
 - (b) Imports—Quantities and sources—trends—periodicity—factors affecting (*e.g.*, tariffs).
 - (c) Total supplies—Quantity—quality—values.

B. Demand.

Quantitative—qualitative—for direct consumption—for processing or manufacture—seasonal variations—factors affecting—analysis of internal and export demand.

C. Prices.

General—trend—price range in relation to quality—Seasonal fluctuations—variations in a market and between markets—cause of variations—market service regarding prices—customary units and methods of sale—relation of 'ready' prices and 'futures' prices (if any)—factors affecting producers prices particularly.

D. Preparation for market.

- (a) Producers' practice in regard to cleaning—sorting or mixing of qualities—adulteration—packing, etc.—illustrations of best, average and worst methods—comparisons with practice elsewhere.
- (b) *Assembling*.—Extent to which practised for home trade or for export—methods observed by merchants and co-operative societies, etc.—comparisons with practice abroad—financial arrangements.
- (c) *Grading and Standardisation*.—Practice by producers and merchants, etc.—relation to requirements of consumers and manufacturers—standardisation of grades, packs, packages, weights and contracts—comparisons with practice in other countries—Future possibilities and definite suggestions for home produce.

E. Conservation and storage.

Types and methods of storage by producers, merchants transport agencies and manufacturers. Extent to which practised—costs—shrinkage losses, etc.—comparisons with other countries—suggestions for improvement—Financial arrangements.

F. *Transportation.*

Methods and costs of transport by road, water or rail—extent to which used—Any special facilities or provision made by transport agencies for carrying the commodity (*e.g.*, special trucks, etc.)—methods and costs of incidental handling (*e.g.*, loading, weighing, discharging, etc.)—Internal produce movement (including coastwise)—quantity and direction—Types of containers in use—suggestions regarding standard containers.

G. *Distribution.*

- (a) *Wholesale distribution* by producers, merchants, co-operative societies, etc.—methods employed in internal (local) trade and in export and import trade—Financial arrangements—size and types of wholesale businesses—comparisons with organised marketing systems abroad.
- (b) *Wholesale markets.*—Types of markets or exchanges in producing areas and in consuming or port areas—methods of conducting business—market dues and other charges—quantities passing through markets—Government or Municipal regulations affecting markets.
- (c) *Retail distribution.*—Methods and amount sold by producers and merchants, etc.—retail markets—Practice in regard to retailing.

H. *Processing and Industrial utilisation.*

Types and methods of processing applied to primary products for subsequent sale—Quantities, qualities and grades of processed product—Question of standard grades and weights—Quantities used for industrial purposes—industrial practice and location of factories—village or domestic industries—quantity and types of manufactured products and bye-products—methods of distribution. Historical survey of development and future possibilities in India.

Additional points.

A survey would also include notes on Trade Marks, Advertising, Propaganda, Research work on the production of suitable market types, the Regulation and Control of the trade by associations, etc., Geographical distribution of varieties, breeds and so on and would include the necessary statistical tables, maps and photographs to illustrate the different types of produce, methods of distribution, suggested standard grades and packages, etc., etc.

ENCLOSURE II.

COPY OF A LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 991-A/33, DATED THE 30TH AUGUST 1934.

SUBJECT :—*Marketing : scheme for improvement of marketing in India.*

With reference to the correspondence ending with your letter No. F. 9-M. (2) 34, dated 17th August 1934, I am directed by the Govern-

ment of Bombay (Transferred Departments) to forward a copy of the proposals (not cyclostyled) framed by the Director of Agriculture for the appointment of a Provincial Marketing staff in connection with the scheme for the improvement of marketing in India, together with a copy of a further letter from that officer, No. 32, dated 21st August 1934, containing an estimate of the expenditure involved over a period of five years. Mr. E. J. Bruen, Live Stock Expert, will guide and control the work regarding live-stock produce. It is also proposed to entrust to him the supervision of the other three marketing officers for one year at least. The Government of Bombay approve the Director's proposals and recommend them for the favourable consideration of the Imperial Council of Agricultural Research. I am to add that Mr. Bruen will be asked to attend the forthcoming meeting of the Advisory Board of the Imperial Council of Agricultural Research from 3rd to 8th September 1934 as a visitor.

2. As regards Sind, I am to forward a copy of the letter from the Chief Agricultural Officer in Sind, No. 369, dated 20th August 1934, containing his proposals for a similar organisation for Sind. In the short time available, the Government of Bombay have no time to scrutinize his proposals. I am, however, to add that Mr. A. M. Livingstone, Marketing Expert to the Imperial Council of Agricultural Research, has been requested to take an early opportunity of visiting Sind with a view to acquainting himself with the special problems affecting Sind and discussing them with the Chief Agricultural Officer in Sind. It is requested that in the meantime, the Sind proposals may also be provisionally sanctioned.

(Sind proposals have the approval of the Bombay Government, *vide* their telegram, dated 1st September 1934—not printed.)

COPY OF A LETTER FROM THE CHIEF AGRICULTURAL OFFICER IN SIND, TO THE UNDER SECRETARY, TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, No. 369, DATED THE 20TH AUGUST 1934.

SUBJECT :—*Scheme for improvement of marketing in India*

I have the honour to acknowledge receipt of your endorsement No. 991-A.133, dated 8th August 1934, forwarding copies of letter No. F. 9-M. (2)134, dated the 2nd August 1934 from the Secretary, Imperial Council of Agricultural Research and accompaniments on the above noted subject and has the honour to state as under :—

2. In para. 5 (b) of the letter from the Secretary, Imperial Council of Agricultural Research under reference, dealing with Provincial Marketing staff, it is proposed that each Province should appoint at most three Assistant Marketing Officers and necessary subordinate staff and contingencies to be paid for from a grant from central funds for a period of five years. The total expenditure on this account must not exceed Rs. 20,000 per annum. It is also laid down that the salary of these officers should not exceed that proposed for Central Assistant Marketing Officers, which is initial pay of Rs. 200 to Rs. 600 according to qualifications subject to temporary emergency cut. Officers not in pensionable Government service appointed to these posts will not be eligible for overseas pay but will be eligible to subscribe to contributory provident fund

of Government servants at a rate to be fixed with due regard to their present emoluments.

3. In the detailed budget estimates appended to my memorandum No. 369 of 1934, dated 12th March 1934 to the Under Secretary to the Government of Bombay, Revenue Department on the improvement of the marketing of agricultural produce. I had proposed the appointment of one Provincial Marketing Officer in the grade of Rs. 300—25—350 and of six marketing superintendents in the grade of Rs. 110—5—120 with necessary subordinate staff and contingencies for marketing inquiries in Sind over a period of three years. The total cost of these proposals was Rs. 20,320 in the first year, Rs. 18,980 in the second year and Rs. 19,640 in the third year, i.e., Rs. 58,940 in all, say Rs. 59,000. I am still of the opinion that an establishment organised on these lines and directed by the Chief Agricultural Officer in Sind with the advice of a non-official *ad hoc* Advisory Committee for each item of agricultural produce, the marketing of which is taken for investigation (reference para. 2 of my memorandum referred to above) would be the most effective and co-ordinated means of conducting marketing investigations in Sind. In view, however, of the decision arrived at by the Imperial Council of Agricultural Research, which body is financing the scheme for a period of five years, I have the honour to append herewith a revised budget estimate in accordance with the instructions contained in the letter under reference from the Secretary, Imperial Council of Agricultural Research.

4. With regard to the appointment of the Sind Provincial Marketing staff, i.e., the three Assistant Marketing Officers required under the scheme, I have the honour to suggest that these posts be widely advertised as early as possible, the necessary qualifications being as stated in paragraph 6 of the letter from the Secretary, Imperial Council of Agricultural Research under reference. A knowledge of Sindhi will be essential and preference should be given to qualified Sindhi candidates.

Marketing investigations in Sind should commence with (a) wheat, (b) rice and (c) oilseeds, one Assistant Marketing Officer being assigned to work on each of these agricultural products, under the direct supervision of the Chief Agricultural Officer in Sind advised and assisted by three *ad hoc* Committees of non-officials, i.e., one Committee for each product under investigation.

The detailed programmes of investigation will be worked out in consultation with the Central Marketing Expert as proposed in paragraph 8 of the letter under reference from the Secretary, Imperial Council of Agricultural Research.

COPY OF A LETTER FROM THE SECRETARY TO GOVERNMENT, NORTH-WEST FRONTIER PROVINCE, TRANSFERRED DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 7401-T.D.N., DATED THE 31ST AUGUST 1934.

SUBJECT :—*Marketing staff.*

I am directed to refer to your letter No. F. 9-M. (2)34, dated the 2nd August 1934, and to request that, with reference to paragraph 5 (b) of your letter under reply, provision may kindly be made for one Assistant Marketing Officer for this Province.

2. The Local Government welcome the proposals of the Government of India, which coincide with the activities already initiated in this Province on a small scale. Propaganda with regard to marketing has been carried on by the Co-Operative Societies Department. A scheme for the grading and marketing of fruit from the Tarnab Government Farm has worked well this year and local zamundars have been encouraged to join in the scheme. Military contracts for barley, etc., have been obtained and schemes for obtaining military contracts for potatoes are under consideration.

3. I am to say that as soon as funds can be provided by the Government of India for the appointment of an Assistant Marketing Officer for this Province, the Local Government propose to appoint a second Assistant Marketing Officer together with a clerk and a typist in addition to the marketing staff already existing in connection with the schemes mentioned. Office accommodation for the whole marketing staff will be provided.

LETTER FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, TO THE SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, No. 32 OF 1934, DATED THE 21ST AUGUST 1934.

I have the honour to refer to correspondence ending with my confidential letter No. 32/9777 of 16th August 1933, and to forward herewith my final proposals for the Provincial Marketing Staff for Bombay.

2. During the last two days, I have had the great advantage of the presence of Mr. A. M. Livingstone, the Marketing Expert of the Imperial Council of Agricultural Research. He informs me that in order to do justice to this marketing investigation, most provinces and large States have now (in each case) seconded a senior officer to be the local marketing officer, his pay and allowances being met by the local Government concerned. As it seems at present unlikely that the Bombay Government can spare and pay a senior man, the proposals below suggest instead the utilisation of the services of junior officer and a part of the time of a senior officer. *This arrangement involves no additional expenditure to the Bombay Government.*

3. The requirements to be met are—

(a) effective supervision.

(b) a sufficient number of junior marketing assistants, so that all the products shall be effectively covered.

4. It appears that it is essential to have one junior marketing officer for each of the groups under "Crops" *i.e.*—

Cereals (wheat and rice).

Oilseeds (groundnut and linseed).

Plantation and special crops (tobacco and fruit).

5. It appears necessary to have an additional junior marketing officer specially on livestock products. Strictly speaking one junior marketing officer is hardly a sufficient proportion of the staff for this subject in the Bombay Presidency, which produces over 80 per cent. of all the butter manufactured in India. It is proposed, however, to compensate for this by the nature of the supervision by the senior officer.

6. The Central Government are not prepared to give more than *three* assistant marketing officers. We need four. The fourth one can be found by utilising the services of one of Mr. Bruen's existing staff who will be taken off his present duties and put on to marketing enquiry. Mr. Bruen has offered one of his assistants for this purpose.

7. It is proposed that Mr. Bruen should guide and control this officer and by his own special knowledge compensate for the fact that only *one* marketing officer can be put on this large group of products.

8. It is considered economical and feasible, for at least the first year, to make Mr. Bruen responsible for the supervision of the other three officers as well, and he has expressed his willingness to undertake this work.

9. For this purpose he (Mr. Bruen) will need a clerk and peon to be paid from the Rs. 20,000 to be allotted to Bombay by the Central Government, and this is arranged for in the revised budget attached to this letter.

10. The other junior marketing officers will be recruited from the existing personnel of the Bombay Agricultural Department, and paid by the Central Government. Their places in the Bombay Agricultural Department will be filled by new men.

Statement showing the revised Budget Estimates for the Provincial Marketing Staff (Bombay) for a period of five years.

Name of primary unit.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
1. Pay of officers—						
Three class II officers in the Bombay Agricultural Service at Rs. 200 p. m. each in the grade of Rs. 170—500 ..	7,200	7,740	8,280	8,820	9,360	41,400
2. Pay of Establishment—						
(1) One clerk at Rs. 60 p. m. in the grade of Rs. 60—5/2—75	720	720	780	780	840	3,840
(2) Four clerks at Rs. 30 p. m. each in the grade of Rs. 25—5/2—55 ..	1,440	1,440	1,680	1,680	1,920	8,160
(3) Five peons at Rs. 18 p. m. each ..	1,080	1,080	1,080	1,080	1,080	5,400
3. Allowances and Honoraria—						
Travelling Allowance ..	6,000	6,000	6,000	6,000	6,000	30,000
4. Contingencies ..	3,200	2,000	2,000	2,000	2,000	11,200
Total ..	19,640	18,980	19,820	20,360	21,200	100,000

NOTE.—As the orders regarding the rates of increment in the above scale of class II officers have not been issued by Government the rate of increment at Rs. 15 has been taken for calculating the total amount of pay for the subsequent years.

Detailed Budget Estimates (revised) for a period of five years for Provincial Marketing Staff (Sind) and establishment in accordance with instruction contained in letter No. F. 9-M.(2)/34, dated 2nd August 1934 from the Secretary, Imperial Council of Agricultural Research, to the Secretary to the Government of Bombay, Revenue Department.

Pay.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Three Assistant Marketing Officers on initial pay of Rs. 200 to Rs. 600 according to qualifications. Average taken at Rs. 300—25— 400	10,800	11,700	12,600	13,500	14,400	63,000
Three clerks on Rs. 30 p. m. ..	1,080	1,080	1,080	1,080	1,080	5,400
Three peons on Rs. 18 p. m. ..	648	648	648	648	648	3,240
Pay Total ..	12,528	13,428	14,328	15,228	16,128	71,640
Allowances and Honoraria—						
Travelling Allowance ..	3,000	3,000	3,000	3,000	3,000	15,000
Allowances Total ..	3,000	3,000	3,000	3,000	3,000	15,000
Contingencies—						
(a) Non-recurring	2,500	..	..	..	..	2,500
(b) Recurring—						
Rents rates and taxes Miscel- laneous, e.g., service stamps, telegrams, freight charges, etc.	2,000	1,500	1,500	1,000	1,000	7,000
Contingencies Total ..	4,500	1,500	1,500	1,000	1,000	9,500
GRAND TOTAL ..	20,028	17,928	18,828	19,228	20,128	96,140

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF
BENGAL, AGRICULTURE AND INDUSTRIES DEPARTMENT,
No. 4019, DATED THE 28TH AUGUST 1934.

I am directed to refer to your letter No. F. 9-M (2)/34, dated the 2nd August 1934.

2. In reply, I am to say that the scheme for the appointment of a marketing staff in Bengal was discussed with Mr. A. M. Livingstone, Marketing Expert, Imperial Council of Agricultural Research, on the 8th instant, with special reference to the needs of this province. It was agreed that a staff of five officers consisting of one Senior Marketing Assistant and four Marketing Assistants, is actually required in this province to deal with the five main groups specified in paragraph 5 of your letter, *viz.* :—

- (a) plantation crops, including tobacco, fruits and vegetables ;
- (b) cereals, including wheat and rice ;
- (c) oilseeds, including mustard and linseed ;
- (d) dairy products and poultry ; and
- (e) live-stock products including hides, skins and fish.

The Senior Marketing Assistant will be in charge of plantation crops, and will in addition supervise and coordinate the work of the four Marketing Assistants under the instructions of the Central Marketing Staff.

3. I am to enclose a detailed estimate of cost of a scheme for Bengal involving a total recurring expenditure of Rs. 98,260 spread over a period of five years and a non-recurring expenditure of Rs. 1,570. The scale of pay of Rs. 300—50/2—400 proposed for the Senior Marketing Assistant is based on the revised scale for the Bengal Higher Agricultural Service, *viz.*, Rs. 300—50/2—700—75/2—1,000, while that of the four Marketing Assistants (Rs. 125—5/2—135) follows the revised scale for the Bengal Subordinate Agricultural Service, Class I (Executive), *viz.*, Rs. 125—5/2—130—10/2—150—15/2—180—10/2—250. As a result of the prevalent unemployment among the educated classes men qualified to hold the post of Marketing Assistant can be secured in Bengal on the rates of pay proposed. The pay of the office establishment has also been fixed in accordance with the new scales of pay for officers of similar status. The other items of expenditure represents the minimum requirements of this scheme.

4. The Government of Bengal (Ministry of Agriculture) note that it is the desire of the Council to assist individual provinces in undertaking the work of the scheme by making provision from central funds for the appointment in each province of at most three officers, the senior marketing officers being provided by the province concerned. They regret to observe, however, that the state of the provincial finances in Bengal makes it most improbable that any part of the expenditure on the scheme can be met by Local Government. At the same time, owing to reduction of the staff of the Agricultural Department to a minimum as a measure of retrenchment, the Government of Bengal would not feel justified in putting one of their regular officers to work on the scheme without replacing him. Accordingly, while they fully appreciate the importance of the proposals and their potential value to all parts of the country, they fear that it will not be possible for them at present to incur expenditure from provincial revenues on participation in the scheme, and trust that the Imperial Council will agree to defray the expenditure detailed in the statement from funds at their disposal.

Estimate of the cost of providing Marketing Staff in the Bengal Agricultural Department.

Non-recurring.

Furniture ..	Rs.
2 Typewriters ..	500
2 Cameras ..	770
	300
Total ..	1,570

	1st year.	2nd year.	3rd year.	4th year.	5th year.
<i>Recurring.</i>	Rs.	Rs.	Rs.	Rs.	Rs.
1 Senior Marketing Assistant @ Rs. 300—50/2—400 ..	3,600	3,600	4,200	4,200	4,800
4 Marketing Assistants @ Rs. 125—5/2—135 each	6,000	6,000	6,240	6,240	6,480
1 Head Clerk—Stenographer @ Rs. 75—5/2—85 ..	900	900	960	960	1,020
2 Clerks @ Rs. 40—5/2—50 each ..	960	960	1,080	1,080	1,200
6 Peons @ Rs. 13 each ..	936	936	936	936	936
Travelling Allowance for Senior Marketing As- sistant ..	2,000	2,000	2,000	2,000	2,000
Travelling Allowance for 4 Assistants ..	3,000	3,000	3,000	3,000	3,000
Contingencies for Senior Marketing Assistant ..	1,200	1,200	1,200	1,200	1,200
Contingencies for 4 Assistants	240	240	240	240	240
	18,836	18,836	19,856	19,856	20,876

Total recurring for 5 years .. Rs 98,260

Total non-recurring .. 1,570

99,830

Say .. 1,00,000

LETTER FROM THE SECRETARY TO GOVERNMENT, UNITED PROVINCES, No.
722-A., DATED THE 28TH AUGUST 1934.

With reference to your letter No. F. 9-M. (2)/34, dated August 2, 1934. I am directed to say that pending a decision on the question of appointing a Provincial Marketing Officer from provincial revenues or in the alternative placing an officer on special duty for the purpose, the Governor acting with his Ministers proposes that three Assistant Marketing Officers of the status of the Provincial Agricultural Service, Class II, may be appointed on a scale of Rs. 200—15—260 per mensem for a term of five years from the grant which the Imperial Council proposes to make to each province. The other details of the proposed expenditure are shown in the enclosed statement. It will be seen from the statement that the total expenditure in five years will not exceed a lakh.

2. It is provisionally proposed that the Assistant Marketing Officer in charge of Animal Husbandry products should be attached to the Agriculture Department, although in view of the nature of work to be entrusted to him he has to work in collaboration with the Civil Veterinary Department.

Statement showing provision required in connection with the Marketing Survey of Indian Agricultural Products.

Items.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Remarks.
	Rs.	Rs.	Rs.	Rs.	Rs.	
3 Assistant Marketing Officers (200—15—260) ..	7,200	7,740	8,280	8,820	9,360	With headquarters at— Cawnpore. Etah. Hapur.
1 for Oilseeds and Fibres ..	..	..	..	..	..
1 for Dairy and Poultry (products) ..	..	..	..	..	..
1 for Barley, Wheat and other Cereals ..	..	..	..	..	..
1 Clerk (60—4—80) ..	720	768	816	864	912	
1 Stenographer (60—4—80) ..	720	768	816	864	912	
3 Clerks (50—2—60) ..	1,800	1,872	1,944	2,016	2,098	
5 Peons at Rs. 10/8 ..	630	630	630	630	630	
Travelling allowance for Assistant Marketing Officers ..	3,000	3,000	3,000	4,000*	4,000	
Office rent	1,700	1,700	1,700	1,700	1,700	
Typewriters	2,500	..	..	..	..
Furniture, etc.	1,300	..	..	..	..
Contingencies	1,400	1,400	1,400	1,400	1,400	
Total	20,970	17,878	18,588	20,294	21,002	Rs. 98,730
Contingencies reserve .. ..	..	..	..	..	..	1,270
						<u>1,00,000</u>

* Class II salary and status.

LETTER FROM THE REVENUE SECRETARY TO THE GOVERNMENT OF THE CENTRAL PROVINCES, No. 971/D. O. 60-XIV, DATED THE 23RD AUGUST 1934.

With reference to paragraph 7 of your letter No. F.9-M (2) 34, dated the 2nd August 1934, I am directed by the Government of the Central Provinces (Ministry of Agriculture) to submit for the consideration of the Imperial Council of Agricultural Research the following proposals for a marketing staff to work under the Provincial Marketing Officer of this province.

	Rs.
1 Assistant Marketing Officer at Rs. 400—25—500—Average Rs. 450	5,400
2 Assistant Marketing Officers at Rs. 200—25—300—Average Rs. 250	6,000
Head clerk at Rs. 70—5—120—Average Rs. 80	960
Accountant at Rs. 70—2—80—Average Rs. 74	888
Typist at Rs. 30—2—40—Average Rs. 34	408
4 peons at Rs. 13	624
Travelling allowance of Assistant Marketing Officers and orderly peons	3,000
Contingencies	3,000
Total	20,280
or say	20,000

The rates of pay have been calculated on the assumption that the proposed staff will be selected from men already in Government service in the province. Government considers that if the fullest advantage is to be taken of the scheme in five years it will be essential to appoint people who already possess knowledge of local conditions. The reason for the higher rate of pay suggested for one of the post of Assistant Marketing Officer is that it is intended to put in charge of the Agricultural produce a class II officer who is already drawing Rs. 375 per mensem and will shortly be due for an increment.

2. The allocation of subjects will be as follows :—

(1) Plantation and special crops (fruit ; hemp, tobacco, etc.)	Marketing Officer.
(2) Cereals	Assistant Marketing Officer.
(3) Oil Seeds	Do.
(4) Animal Husbandry products	Do.

In this province the milk, butter, eggs and poultry industries are of such small dimensions that the marketing of these products can safely be combined with that of live stock, etc. The pay and travelling allowance of the Provincial Marketing Officer and orderly peons for his use are being debited to the local Government.

3. I am to add that these proposals were discussed with Mr. Livingstone, the Marketing Expert to the Government of India at his recent visit to this province. The employment of the staff detailed in paragraph 1 above can be made as soon as sanction is received from the Government of India provided it is not necessary to recruit through the Public Service Commission.

LETTER FROM THE DEPUTY SECRETARY TO GOVERNMENT, PUNJAB, DEVELOPMENT DEPARTMENT, No. 1280-D. (S), DATED THE 28TH AUGUST 1934.

I am directed to acknowledge receipt of your letter No. F. 9-M (2)/34, dated the 2nd August, 1934, and to say that the Punjab Government (Ministry of Agriculture) welcome the scheme outlined in your letter for the improvement

of marketing in India which this Government recognise to be a matter of urgent importance. They also greatly appreciate the assistance which the Government of India wish to offer by providing a sum of Rs. 20,000 per annum for the pay, etc., of three Assistant Marketing Officers for this Province.

2. So far as this province is concerned an officer of the Punjab Forest Service has already been placed temporarily on special duty as Provincial Marketing Officer. As there are no separate markets for the disposal of individual commodities it is proposed to divide the province into four regions, so that each officer deals with all the products which are produced in the same area or which follow the same channels of trade. Of the four regions three will be in charge of Assistant Marketing Officers and the fourth under the direct charge of the Marketing Officer, who will in addition generally supervise the work of the Assistant Marketing Officers.

3. The main work of the staff will be to look into the whole question of the marketing of agricultural produce, including methods of selling, facilities which the farmer has for taking his crop produce to the market, the quality of the produce marketed, communications, etc. They will work in close co-operation with the Central Marketing Expert and will collect the necessary information required regarding market surveys as outlined in the Statement of general considerations regarding the appointment of Provincial Marketing Staffs, appended to your letter under reference. The Punjab Government (Ministry of Agriculture) will be glad if the Marketing Expert finds an opportunity to visit the Punjab and discuss the provincial scheme with the Local Government and its officers, who will co-operate in this work in accordance with the detailed general scheme for each commodity to be drawn up by the Central Marketing Staff.

4. The Punjab Government (Ministry of Agriculture) have decided to attach the Marketing staff in this province to the Director of Agriculture and accept the view that the Assistant Marketing Officers should be practical men accustomed to a rural environment and with an aptitude for Agriculture. That they should have a knowledge of farm production in addition to other qualifications is—this Government consider—very important.

5. An estimate of the annual expenditure on the Assistant Marketing Officers is given below :—

	Rs.
3 Assistant Marketing Officers on an average pay of Rs. 300 p. m. . .	10,800
3 Peons at Rs. 14 per mensem each	504
Clerical establishment	2,700
Travelling Allowance	3,600
Contingencies	2,396
Total annual cost	20,000

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BIHAR AND ORISSA, EDUCATION AND DEV. DEPARTMENT, No. 782-D. R., DATED THE 21ST AUGUST 1934.

With reference to your letter No. F. 9-M. (2)/34, dated the 2nd August 1934, I am directed to say that the Government of Bihar and Orissa (Ministry

of Education) are prepared to participate in the general scheme for the development of marketing facilities for agricultural and animal products in India and I am to forward for the consideration of the Imperial Council of Agricultural Research a marketing scheme which has been drawn up by the Director of Agriculture, Bihar and Orissa, after discussion with Mr. Livingstone, the Marketing Expert to the Imperial Council of Agricultural Research.

2. It will be observed that the scheme will cost Rs. 2,06,198 spread over a period of five years of which the Imperial Council will be expected to contribute a total of Rs. 1,00,798. The contribution which the local Government propose to make will be in the shape of the pay, special pay and part of the travelling allowance of one of their senior Deputy Directors of Agriculture. The local Government consider that for a new work of this kind it is absolutely necessary to have a really senior officer in charge with sufficient initiative and power of organisation and control to co-ordinate the work of the three junior officers. They propose therefore to place Lt.-Col. C. A. Maclean, I.A.S., on special duty as Senior Marketing Officer for one year in the first instance. They however wish to make it clear that if at the end of the year it is found that the work could be entrusted to a junior officer or to Lt.-Col. Maclean in addition to his normal work as Deputy Director, they will have full liberty to make some such arrangement.

3 Lt.-Col. Maclean is now on leave and he is being asked to acquaint himself with the more important aspects of marketing investigations undertaken by the Ministry of Agriculture in the United Kingdom. He will stay in London for about a fortnight and will make a special study of the subject. The local Government will meet the cost of his travelling and halting allowance on this account.

4. The provincial marketing staff will co operate closely with the central staff at all stages of the work. It is proposed that, before the work actually starts in the province, the junior marketing officers should go for a preliminary instructional course for a period of about a fortnight under the marketing staff of the Imperial Council of Agricultural Research.

5. I am to request that the Council may be moved to sanction the scheme and to allot necessary funds as early as possible so that the marketing investigations may be undertaken in Bihar and Orissa along with the investigations undertaken by the Council.

Marketing Scheme—Bihar and Orissa.

Simultaneously with the marketing investigations which will be started shortly by the Imperial Council of Agricultural Research it is necessary to undertake similar investigations in Bihar and Orissa. The Marketing Officer and his staff must be specialists with extensive knowledge of the crops with which they have to deal. They must be capable of dealing with the cultivator, the village mahajan, the mofassil trader and the businessman in Central markets.

Before the development of Agricultural Markets or the fixation of produce standards and grades both for internal and external markets can be undertaken it is necessary to undertake a detailed survey of the marketing of agri-

cultural produce as carried on at present. For this purpose the products of Bihar and Orissa may be grouped into four major groups.

1. Cereals—Rice, Wheat and Barley,
2. Oil Seeds—linseed, Rope and Mustard and Castor,
3. Special Crops—Tobacco, Chillies, Fruits and vegetables, and
4. Animal husbandry products—Live stock, dairy products, Hides and Skins, wool and poultry.

For the study of marketing of these four groups, four officers, each preferably a specialist, in his own line, are necessary. One of these must be a very senior man capable of co-ordinating and supervising the work of the other three in addition to carrying out investigations on one of the four groups himself. The Department of Agriculture, Bihar and Orissa, can provide such an officer in the person of Lt.-Col. C. A. Maclean, M.C., M.B.B., I.A.S., Deputy Director of Agriculture, who has made a special study of Animal husbandry and is thus fully competent to undertake the study of the marketing of this Group. Having had nearly 15 years experience as a Deputy Director he will be able to supervise and coordinate the work of the other three officers. His pay, including special pay and sterling overseas pay will be paid by the Government of Bihar and Orissa. But the Imperial Council of Agricultural Research will be expected to find an additional sum of Rs. 1,000 a year to enable him to tour over the whole province, as the provision of Rs. 2,000 for his travelling allowance in the provincial budget will be inadequate.

The cost on account of the other three Junior Marketing officers, who should be on about the same scale of pay as members of the Provincial Agricultural Service, together with all expenses on account of their travelling expenses, office expenses, office staff, contingencies and menial staff and the additional travelling allowance of the Senior marketing officer should be borne by the Imperial Council of Agricultural Research. The details in the table below show the funds required from the Imperial Council of Agricultural Research :—

No.	Item.	1st year.	2nd year.	3rd year.	4th year.	5th year.
1	3 Junior Marketing Officers—Grade 200—40/2—300 ..	7,200	7,200	8,640	8,640	10,080
2	Travelling Allowance of 3 Junior M. Officers and staff ..	5,400	5,400	5,400	5,400	5,400
3	Head Clerk 65—2—75 ..	780	804	828	852	876
4	2nd Clerk 40—2—50 ..	480	504	528	552	576
5	One tour clerk 40—2—50 ..	480	504	528	552	576
6	Two Clerk Typists 30—2—40 ..	720	768	816	864	912
7	2 orderly peons* at Rs. 10—1—12 ..	720	804	888	888	888
	5 peons at Rs. 8—1—10 ..					
8	Purchase of 2 Typewriters ..	700	..	..	..	..
9	Office furniture, etc. ..	600	..	..	..	..

Carried over ..

*The orderly peons will be paid a fixed pay of Rs. 10 and the other peons Rs. 8 only, if possible.

No.	Item.		1st year.	2nd year.	3rd year.	4th year.	5th year.
		Brought forward	..	..	..	..	..
10	Office contingencies (stationery, stamps, liveries, Hot weather charge, etc.) .. ..	..	1,050	1,000	1,000	1,000	1,000
11	Hire of office .. ..	..	600	600	600	600	600
12	Additional travelling allowance of the senior marketing officer ..	..	1,000	1,000	1,000	1,000	1,000
	Total	..	19,730	18,584	20,228	20,348	21,908

GRAND TOTAL—Rs. 1,00,798.

The contribution of the Government of Bihar and Orissa to the scheme will be :—

1. One Senior Deputy Director of Agriculture in the I. A. S. Present pay Rs. 1,100 plus £30 S. O. P.
2. Special pay of the Deputy Director of Agriculture .. Rs. 1,200 a year.
3. Travelling allowance of the Deputy Director of Agriculture. Rs. 2,000 per annum.

The Junior Marketing Officers will be recruited through the Public Service Commission, India. It is to be noted that in case suitably qualified men are not available at the rates of pay proposed and the grant of higher initial pay is found necessary, the extra expenditure required on this account will have to be borne by the Imperial Council of Agricultural Research.

It is requested that the Scheme may be sanctioned as a part of the Main Marketing Scheme of the Imperial Council of Agricultural Research.

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF ASSAM, TRANSFERRED DEPARTMENT, No. 1856-E., DATED THE 28TH AUGUST 1934.

I am directed to acknowledge the receipt of your letter No. F. 9-M. (2)34, dated the 2nd August 1934, and to submit, for consideration at the next meeting of the Advisory Board, an estimate of cost in connection with the appointment of two Assistant Marketing Officers in Assam. The estimate provides for appointment of two Assistant Marketing Officers, one for Agricultural produce and the other for live-stock. The crops which are most important to this Province at present are paddy, jute, linseed, rape, mustard, cotton, potatoes and fruits. There are considerable possibilities of development in fruit marketing, particularly oranges and pineapples, both in and outside the province. There are also great possibilities of improving the marketing facilities of live-stock (which have come to notice as the result of recent floods) and of dairy produce. These officers will work under the direct control of the Director of Agriculture. The scheme provides only for a nucleus staff, to be provided from the Council's grant which could be expanded as needs may require and funds allow. The Government of Assam, while cordially welcoming the proposals, are not at present in a position to provide for a larger staff from their own resources.

ESTIMATE OF COST IN CONNECTION WITH THE APPOINTMENT OF TWO ASSISTANT MARKETING OFFICERS IN ASSAM.

Details.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<i>(To be provided by the Imperial Council of Agricultural Research).</i>						
Two Assistant Marketing officers on Rs. 200—15—275 per mensem each	4,800	5,160	5,520	5,880	6,240	27,600
Travelling allowance at Rs. 1,400 for each	2,800	2,800	2,800	2,800	2,800	14,000
Two peons (one for each) at Rs. 14 per mensem	336	336	336	336	336	1,680
One clerk on Rs. 75 per mensem	900	900	900	900	900	4,500
Travelling allowance for establishment	500	500	500	500	500	2,500
Total ..	9,336	9,696	10,056	10,416	10,776	50,280
<i>To be provided by Local Government.</i>						
Contingencies	600	600	600	600	600	3,000
Furniture, camera, etc., at Rs. 500 for each	1,000	..	..	..	..	1,000
Total ..	1,600	600	600	600	600	4,000

Madras.

Summary of proposals made by the Director of Agriculture to the Government of Madras for the appointment of Junior Marketing Officers with the grant from the Imperial Council of Agricultural Research.

Besides the Senior Marketing Officer already appointed by the Madras Government, it has been proposed that three Junior Marketing Officers with clerical and menial staff be appointed at a cost which has been estimated to be Rs. 20,000 a year on the average for five years, besides the sum representing the cost of leave and pensionary contributions. The work has been proposed to be divided among the Marketing Officers thus :

Senior Marketing Officer : Rice and dairy products (also
(To be paid from Provincial supervision of the junior
Funds). officers).

Junior Marketing Officers :

- First Fruit, tobacco and other special plantation products.
- Second Oilseeds including groundnut and coconuts.
- Third Livestock and hides and skins.
- Total establishment expenditure Rs. 20,000 per annum.

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BURMA, No. 273-O.,
DATED THE 23RD AUGUST 1934.

With reference to your letter No. F. 9-M. (2)/34, dated the 2nd August 1934, I am directed to say that, in view of the special circumstances of Burma and the very short notice received, it has not been possible to prepare detailed proposals for a marketing staff for Burma in time for the meeting of the Advisory Board of the Imperial Council of Agricultural Research to be held from the 3rd to the 8th September 1934. They will, however, be forwarded in time to be placed before the next meeting of the Advisory Board of the Council.

2. Meanwhile the Director of Agriculture will by interchange of views with other Directors in India and by attending the September meeting of the Advisory Board be able to collect sufficient information upon the scope and work of Provincial Marketing Officers to enable him to prepare a scheme for the Local Government upon his return that is likely to commend itself to the Council.

ENCLOSURE III.

LETTER TO ALL MINOR ADMINISTRATIONS, No. F. 9-M. (4)/34, DATED THE
31ST AUGUST 1934.

SUBJECT :—*Scheme for the improvement for marketing in India.*

I am directed to forward for information a copy of a circular letter to the Provincial Governments, No. F. 9-M. (2)/34, dated the 2nd August 1934, with enclosures on the subject mentioned above.

2. It will be observed that in pursuance of the recommendations of the Royal Commission on Agriculture and the Banking Enquiry Committee, the Government of India have decided, in consultation with the local Governments, to embark on a comprehensive marketing scheme with a view to improving the economic condition of producers in this country. The scheme will be operated by the Imperial Council of Agricultural Research.

3. The Marketing Expert (Mr. A. M. Livingstone) who has already been appointed on the staff of the Imperial Council of Agricultural Research and who will be at the head of the organisation has drawn up a programme of work which falls into three main divisions, namely,

- (1) Investigation work (including marketing surveys).
- (2) Development work, and
- (3) Work on grade standards.

The work will commence with five groups including 14 different commodities, viz., (i) cereals (wheat and rice), (ii) oilseeds (groundnuts and linseed), (iii) plantation of special crops (tobacco and fruit), (iv) dairy products, etc., (milk and butter, eggs and poultry, and (v) livestock, etc. (hides, skins and wool, livestock, meat and fish), and with a view to ensure its smooth conduct, it has been considered necessary to appoint an additional staff at the centre as well as in the several provinces. The provincial officers will be employed under the local Governments concerned, but will be expected to co-operate in the work in accordance with detailed schemes to be drawn up by the Central Marketing Staff for individual commodities.

4. As the need for economic revival extends all over India, it is expected that the Minor Administrations directly under the Government of India would like to take advantage of the Central Marketing Staff, particularly in regard to investigation work. It may, however, be noted that the staff available at the centre would be rather limited and it is therefore desirable that each Administration should itself render some assistance and be prepared to co-operate either with the Central Marketing Officers or the Marketing Officers of neighbouring provinces or States in such a way as to bring the marketing conditions of the Administration within the ambit of an all-India survey. For that purpose, it is hoped that each Administration will *at least* nominate some one to whom marketing questions may be referred or who could be consulted by any marketing officers who might have occasion to visit the Administration in the course of their survey work.

5. It is possible that, in view of the seriousness and urgency of the economic problems involved in marketing some of the commodities referred to, the Administrations may already have appointed or may intend to appoint their own marketing staffs, in which case the Marketing Expert, when on tour, will be glad to have the opportunity of consultation with the authorities concerned regarding the extent of the co-operation which might be arranged between the staff in the Administrations and the Central Staff.

6. As the matter is urgent, this Department would be glad to receive suggestions at an early date regarding such arrangements as may conveniently be made for co-operation in this work between the Central Marketing Staff and the appropriate persons in the Administration.

ENCLOSURE IV.

DRAFT LETTER TO THE HON'BLE THE AGENT TO THE GOVERNOR-GENERALS
AND POLITICAL OFFICERS TO BE ISSUED FROM THE F. & P. DEPARTMENT.

Scheme for the improvement of marketing in India.

I am directed to address you in regard to a comprehensive scheme for the improvement of marketing in British India, which is being put into operation by the Government of India through the Imperial Council of Agricultural Research Department.

2. The Royal Commission on Agriculture and the Banking Enquiry Committee recommended the development of marketing facilities for agri-

cultural products (both crops and animal products) with a view to improving the economic conditions of producers in India. The action to be taken to deal with the main marketing problems includes propaganda, and the supply of information in external markets regarding Indian products ; the grading, sorting and bulking of the main staple products ; special market organisations for perishable commodities ; information to India's producers of consumers' requirements both in India and abroad ; the planning of production on the basis of quality and demand ; the establishment and development of regulated markets ; the undertaking of market surveys for the purpose of developing a common plan throughout India ; the establishment of properly organised ' futures ' markets, commodity exchanges and warehouses.

3. The general scheme includes *inter alia* the establishment of a Central Marketing Staff as well as Provincial Marketing Staffs. The latter will be employed under their own Governments, but will be expected to co-operate in the work in accordance with a detailed scheme for each commodity to be drawn up by the Central Marketing Staff.

4. The Marketing Expert (Mr. A. M. Livingstone) who has already been appointed on the staff of the Imperial Council of Agricultural Research and who will be at the head of the organisation has drawn up a programme of work which falls into three main divisions—

- (1) Investigation work (including Marketing surveys),
- (2) Development work, and
- (3) Work on grade standards.

The investigation work includes a series of marketing surveys with immediate reference to the more important commodities grouped as follows :—

I. Crops :—

- (a) Cereals (wheat and rice),
- (b) Oilseeds (groundnuts and linseed),
- (c) Plantation and special crops (tobacco and fruit).

II. Animal Husbandry Products :—

- (a) Dairy Products, etc. (Milk and Butter, Eggs and Poultry),
- (b) Livestock, etc., (Hides, Skins and Wool, Livestock and Fish).

Other matters are also included within the scope of the surveys, namely, regulated markets, marketing organisation, the problems of preservation of produce, standardisation of containers, etc.

5. It is hoped that with the full co-operation of the states the marketing surveys when complete will set out in detail the present system of marketing the commodities concerned not only in each of the provinces and States separately but in respect of inter-provincial, inter-State and foreign trade so as to provide an all-India picture of existing conditions and a common basis for future progress. The report on each survey will set out, in precise technical detail, definite suggestions for standard grades, containers, methods of packing, contract conditions, etc., and will also formulate proposals regarding any form of marketing reorganisation

which may be found necessary to improve existing conditions in the interests of producers.

The work connected with the execution of these surveys will be shared between the Central and the Local Marketing Staffs and the planning of the surveys, compilation of data and preparation of the reports will fall mainly on the Central Staff, although it is to be expected that each Province and State will also require its staff to prepare a separate local marketing survey. (A note is attached outlining the nature and scope of a marketing survey and indicating the kind of information which it will contain.)

6. *The programme of development work* to follow on the completion of the marketing surveys includes the demonstration of the recommendations made as a result of the surveys so as to inform both producers and traders of consumers' requirements and show the suggested standard grades containers, etc. It is contemplated also that some small packing stations should be organised (e.g., for eggs and fruits) to demonstrate the practicability of bulk sorting, grading and packing and the commercial advantages of employing the standards which will be suggested. The development work generally will aim at securing the more extensive use of agreed commodity standards and the better organisation of producers for marketing purposes. The onus of this work will probably fall mainly on the local marketing staffs.

7. *The work on grade standards* will be of a technical character relating to the chemical and physical characteristics of such products as oil-seeds, grains, fruit, etc., and for the testing of grading technique and equipment under practical conditions.

8. The proposed scheme is regarded as a temporary arrangement for a period of about five years and Provincial Governments have already indicated their willingness to co-operate in the scheme to the extent of appointing provincial marketing staffs to co-operate with the Central Marketing Staff. It may be observed that the proposed provincial marketing staffs, as a rule, will consist of a Senior Marketing Officer (of the rank of Deputy Director of Agriculture) and at least three Assistant Marketing Officers (salaries ranging from Rs. 200 to Rs. 600) who will between them share the work on the various groups of commodities referred to.

9. The urgent need for economic revival has been recognised in the Indian States as well as in British India and it is therefore to be expected that the States will readily co-operate in the marketing work. The degree of such co-operation will naturally depend on the extent of the State's resources and the suggestions which follow are made on the assumption that the State concerned falls into one or other of the following categories :—

- (a) States which have already appointed a marketing staff,
- (b) States which intend to appoint such a staff, and
- (c) States which are not in a position to appoint a wholetime marketing staff.

10. Where steps have already been taken to appoint a staff to deal with the improvement of existing marketing conditions in the State I

am to enquire whether it would be possible to arrange for co-operation between the Central Marketing Staff and the Marketing Staff in the State on the lines of the marketing programme drawn up by the Central Marketing Expert. If so I am also to say that the Imperial Council of Agricultural Research would be prepared to make the services of the Central Marketing Staff available to the fullest extent possible in assisting and guiding the work of the State Marketing Officers and in providing any advice or assistance which may be required by the State.

11. If no definite steps have as yet been taken to institute a programme of marketing work in the State or to appoint any marketing staff, the Imperial Council of Agricultural Research wish to suggest that consideration might be given to the possibility of taking action on lines corresponding to the measures already taken in the provinces. (See para. 8 above). It is also suggested that the State may have in view the necessity of ensuring that any marketing officers appointed are practical men accustomed to a rural environment and with an aptitude for agriculture. They should have technical or commercial experience and a knowledge of farm production in addition to the other qualifications. The number of officers appointed should depend on the number and importance of those products produced in the State which are included within the scope of the proposed marketing surveys.

12. The work of collecting the particulars and information required for the marketing surveys will involve briefly :—

- (a) visits to villages and markets in the main centres of production and numerous interviews with producers, merchants, manufacturers, transport and market representatives and others regarding their practice and methods of business in connection with the marketing of each commodity.
- (b) The examination and differentiation in plain and precise technical terms of the various qualities of each product, collecting samples, describing and photographing various processes and method of marketing, grading, packing, etc.
- (c) Accounting within a reasonable degree of accuracy for all the supply of each product produced in the State by indicating its subsequent destination and method of utilisation and describing the routes and channels of trade followed by such produce.
- (d) Collecting from producers and from market authorities, trade or official sources information regarding producers', wholesalers' and consumers' prices weekly, monthly and annually and collecting also information regarding the amount and causes of price margins, differences, fluctuations and variations.

- (e) At a later date the demonstration and supervision of standards and the organisation of marketing generally will form part

of the work. But action on those lines should be deferred until the preliminary marketing surveys have been completed and are available as a sound basis of development. The formation of marketing organisations should not therefore be regarded as among the immediate duties of local marketing officers. They should rather concentrate on investigation and standardisation work.

13. The local marketing programme should cover all the following groups of commodities or such of them as are produced in the State, namely, Cereals, Oilseeds, Plantation and Special Crops, Dairy Produce and Livestock Products. The complete range of commodities concerned should be allocated among the marketing officers and each officer should so far as possible be allotted allied products which are produced in the same area or which follow the same trade channels.

14. Subject to the supervision of the Marketing Expert the Central Marketing Officer concerned with each group of commodities will prepare in detail an outline scheme of investigation for the benefit of local marketing officers and in case of difficulty he will be prepared to visit the States and lend his personal assistance to the local marketing officers. It is desirable that the all-India significance of the work should not be lost sight of. It is therefore proposed that the closest possible relations should be maintained directly between the Local and Central Marketing Staffs in order to afford mutual assistance and to arrive at the greatest possible degree of co-operation and co-ordination.

14. Where the resources of the State do not permit of a whole-time marketing staff being appointed as suggested, it is hoped that some arrangement might be made whereby the services either of the Central Marketing Staff or of neighbouring Provincial Staffs might be made available to a limited extent for marketing survey work in the State concerned and the Imperial Council of Agricultural Research would in such cases be prepared, so far as possible, to make the necessary arrangements. It seems desirable however that each State should itself render some assistance and be prepared to co-operate to the extent *at least* of nominating some one to whom marketing questions might be referred and who could be consulted by any marketing officers (either Central or Provincial) whose services it might be possible to obtain for the purpose of bringing marketing conditions of the State within the ambit of an All-India Survey.

15. As the matter is urgent the Imperial Council of Agricultural Research would be glad to receive suggestions at an early date regarding such arrangements as may conveniently be made for co-operation in this work between the Central Marketing Staff and appropriate persons in the State.

16. If further information is desired to elucidate the points referred to in this letter and in regard to routine matters which may arise in connection with marketing work generally, I am to request that any communications may be sent direct to the Secretary, Imperial Council of Agricultural Research Department, Rock House, Simla S-W.

APPENDIX LXVII.

NOTE, DATED THE 16TH AUGUST, 1934, ON SUBJECT No. 65, PROPOSAL TO APPOINT PROVINCIAL DAIRY COMMITTEE.

Attention is invited to the attached note on the subject mentioned above which has been prepared by the Animal Husbandry Expert to the Imperial Council of Agricultural Research. The subject is now for the consideration of the Board.

Note by Col. A. Olver, C.B., C.M.G., Animal Husbandry Expert, Imperial Council of Agricultural Research, on the subject of 'proposed appointment of Provincial Dairy Committees'.

At the Provincial Economic Conference held in April 1934, general support was given to a proposal to establish Provincial Dairy Committees, and the Government of India have undertaken to address Local Governments on the matter.

The express object of the proposed Committees was to study and develop marketing arrangements and the following suggestions are put forward for consideration as to their composition and line of action.

1. They should be expert committees, under the chairmanship of the senior government official most closely concerned with the improvement of cattle in the Province and should in any case include the Livestock Officer, representative of Provincial Veterinary and Co-operative Departments, a Health Officer, and non-official representatives of the Dairy Industry in the Province.

2. Their function should be to work, in co-operation with the Marketing Officer, to induce progressive development of the production side of the industry, by improved feeding and management of dairy stock ; by encouraging the preservation and registration of the approved progeny of the best milking animals ; by doing everything possible to compel early castration of unsuitable sires ; by organised propaganda for the systematic improvement of the supply and increased consumption of sound and clean dairy products, and by inducing Provincial and municipal authorities to insure better administrative control of the marketing of milk and dairy products.

It is not considered that these Committees should be directly concerned with the actual organisation and development of marketing, which would be the function of the Marketing Officer and his staff, but it is felt that by meeting regularly and discussing local problems affecting the industry they could do a great deal to supplement and assist the work of Marketing Officers and to strengthen the hands of provincial and municipal authorities in relation to the efficient administrative control which is essential for the development of a Dairy Industry in India on modern lines.

A. OLVER.

11th August 1934.

APPENDIX LXVIII.

NOTE, DATED THE 2ND JUNE, 1934, ON SUBJECT NO. 59, REPORT OF THE TRACTOR PLOUGHING WORK CARRIED OUT BY THE BURMAH SHELL OIL STORAGE AND DISTRIBUTING COMPANY OF INDIA, LIMITED, BOMBAY, DURING THE 1933-34 SEASON.

Attention is invited to the enclosed memorandum (with enclosures) No. 260/33-A., dated the 14th October 1933 (not printed) circulated to the Advisory Board in response to which the Board recommended that the application from the Burmah Shell Oil Storage and Distributing Company of India, Limited, Bombay, for a grant of Rs. 7,000 in order to continue experiments on tractor ploughing operations during the 1933-34 ploughing season be sanctioned. As members are aware, the Advisory Board in August 1933 expressed its great appreciation of the experimental work already done by the Burmah Shell Company and asked Mr. Wade—a representative of the Burmah Shell Company—to impress on the Company the great desirability of continuing their experiments for at least one more season. The Company, while agreeing to the Board's suggestion to continue these experiments for one more season, requested the Council to share with them on fifty fifty basis the expenditure to be incurred on the experiments in question which was estimated at Rs. 14,000. The recommendation of the Advisory Board that a grant of Rs. 7,000 be made to the Burmah Shell Company was sanctioned by the Governing Body in November 1933. The Company accordingly continued their experiments during the 1933-34 ploughing season and have now sent in their report thereon (not printed).

2. The Burmah Shell monograph on mechanical cultivation is already in the press. If approved by the Board it is proposed to publish the present report on later experiments in either Agriculture and Livestock in India or the Indian Journal of Agricultural Science.

3. The Vice-Chairman considers that it will be an advantage to have the present report (not printed) also considered in detail by the same technical committee as examined the Company's report for the season 1932-33. The personnel of the aforesaid Committee is as follows :—

1. The Vice-Chairman, Imperial Council of Agricultural Research, Chairman, *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Mr. C. P. G. Wade of the Burmah Shell Company.
4. Mr. Wynne Sayer, Imperial Agriculturist, Pusa.
5. The Director of Agriculture, Madras.
6. The Director of Agriculture, Bombay.
7. The Director of Agriculture, United Provinces.
8. The Director of Agriculture, Punjab.

9. The Director of Agriculture, Bihar and Orissa.
10. The Director of Agriculture, Baroda.

Secretary, Imperial Council of Agricultural Research, Secretary,
ex-officio.

The Committee will meet on some convenient day during the next session of the Advisory Board between the 3rd and the 8th September 1934. The report of the Committee will be submitted to the Advisory Board in due course.

SIMLA,

CHARAN DAS,

The 2nd June 1934.

Secretary.